MINERALS YEARBOOK

1962

Volume III of Three Volumes

AREA REPORTS

Prepared by the field staff of the
BUREAU OF MINES
DIVISIONS OF MINERAL RESOURCES

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Serials

UNITED STATES DEPARTMENT OF THE INTERIOR • Stewart L. Udall, Secretary

BUREAU OF MINES • Marling J. Ankeny, Director

Created in 1849, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

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FOREWORD

MINERALS YEARBOOK, 1962, published in three volumes, provides a record of performance of the Nation's mineral industries during the year, with enough background information to interpret the year's developments.

The three-volume issues of the Yearbook follow this pattern:

Volume I includes chapters on metal and nonmetal mineral commodities except mineral fuels. In addition, it contains a chapter reviewing these mineral industries, a statistical summary, and chapters on mining and metallurgical technology, employment and injuries, and technologic trends. The former "Minor Metals" and "Minor Nonmetals" chapters have been combined in one chapter on Minor Metals and Minerals."

Volume II includes chapters on each mineral fuel and on helium, an employment and injuries presentation, and a mineral-fuels review chapter that summarizes development in the fuel industries.

Volume III contains chapters covering each of the 50 States, plus a chapter on island possessions in the Pacific Ocean, the Commonwealth of Puerto Rico and island possessions in the Caribbean Sea, including the Canal Zone. Volume III also has a statistical summary chapter, identical with that in Volume I, and a chapter on employment and injuries.

Figures in the Minerals Yearbook are based largely upon information supplied by mineral producers, processors, and users, and acknowledgment is made of this indispensable cooperation given by industry. Information obtained from individuals through confidential surveys has been grouped to provide statistical aggregates. Data on individual producers are presented only if available from published or other nonconfidential sources, or when permission of the individuals concerned has been granted.

MARLING J. ANKENY, *Director.*

ACKNOWLEDGMENTS

In preparing this volume of the Minerals Yearbook, the Bureau of Mines was assisted in collecting statistical data and mineral-industry information by State agencies, through cooperative agreements. Many State chapters were reviewed by staff members of these agencies, and in some instances the staff members collaborated in preparing the chapters and are shown as coauthors. For this assistance acknowledgment is made to the following cooperating organizations:

Alabama: Geological Survey of Alabama.
Alaska: Department of Natural Resources.
Arizona: Arizona Bureau of Mines.
Arkansas: Geological and Conservation Commission; Arkansas Oil and Gas Commission; Department of Revenue.
California: Division of Mines and Geology.
Delaware: Delaware Geological Survey.
Florida: Florida Geological Survey.
Georgia: Geological Survey of Georgia.
Hawaii: Department of Land and Natural Resources.
Idaho: Bureau of Mines and Geology.
Illinois: State Geological Survey Division.
Indiana: Geological Survey, Department of Conservation.
Iowa: Iowa Geological Survey.
Kansas: Conservation Division, State Corporation Commission and State Geological Survey of Kansas.
Kentucky: Kentucky Geological Survey.
Louisiana: Louisiana Geological Survey and Louisiana Department of Conservation.
Maine: Geological Survey of Maine.
Maryland: Department of Geology, Mines, and Water Resources.
Michigan: Geological Survey Division, Department of Conservation.
Mississippi: Mississippi Geological Survey, Mississippi State Oil and Gas Board, and Oil and Gas Severance Tax Division, Mississippi State Tax Commission.
Missouri: Division of Geological Survey and Water Resources, Department of Business and Administration.
Montana: Montana Bureau of Mines and Geology.
Nevada: Nevada Bureau of Mines.
New Hampshire: Development of Resources and Economic Development.
New Jersey: Bureau of Geology and Topography.
New York: New York State Science Service.
North Carolina: Geological Survey of North Carolina.
North Dakota: North Dakota Geological Survey.
Oklahoma: Oklahoma Geological Survey and Oil and Gas Conservation Department; Oklahoma Corporation Commission, Gross Production Division; Oklahoma Tax Commission.
Oregon: State Department of Geology and Mineral Industries.
Pennsylvania: Bureau of Topographic and Geological Survey.
Puerto Rico: Mineralogy and Geology Section, Economic Development Administration, Commonwealth of Puerto Rico.
South Carolina: Geological Survey of South Carolina.
South Dakota: State Geological Survey.
Tennessee: Department of Conservation and Commerce.

Texas: Bureau of Economic Geology, The University of Texas; Oil and Gas Division, Railroad Commission of Texas; Oil and Gas Division, State Comptroller of Public Accounts.
Utah: Utah Geological and Mineralogical Survey.
Virginia: Division of Mineral Resources.
Washington: Division of Mines and Geology, Department of Conservation and Development.
West Virginia: West Virginia Geological and Economic Survey.
Wisconsin: Wisconsin Geological Survey.
Wyoming: The Geological Survey of Wyoming.

Except for the two review chapters, this volume was prepared by the field staffs of the Divisions of Mineral Resources. All manuscripts upon which this volume is based have been reviewed to insure statistical consistency among the tables, figures, and text, between this volume and volumes I and II, and between this volume and those for former years, by a staff supervised by Kathleen J. D'Amico, who was assisted by Julia Muscal, Helen L. Gealy, Helen E. Tice, Mary E. Daugherty, Nellie W. Fahrney, Robert E. Anderson, and Joseph Spann.

Minerals Yearbook compilations are based largely on facts provided by the mineral industries. Acknowledgment is made of the willing contribution by both companies and individuals of these essential data.

CHARLES W. MERRILL,
Chief, Division of Minerals.

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Statistical Summary of Mineral Production

By Kathleen J. D'Amico [1]

THIS SUMMARY appears in Minerals Yearbook volumes I and III, which cover mineral production in the United States, its island possessions, the Canal Zone, and the Commonwealth of Puerto Rico, as well as the principal minerals imported into and exported from the United States. The several commodity and area chapters contain further details on production. A summary table comparing world and U.S. mineral production also is included.

Mineral production may be measured at any of several stages of extraction and processing. The stage of measurement used in the chapter is normally what is termed "mine output." It usually refers to minerals in the form in which they are first extracted from the ground, but customarily includes for some minerals the product of auxiliary processing operatons at or near mines.

TABLE 1.—Value of mineral production in the United States,[1] 1925–62, by mineral groups [2]

(Millions)

Year	Mineral fuels	Nonmetals (except fuels)	Metals	Total	Year	Mineral fuels	Nonmetals (except fuels)	Metals	Total
1925	$2,910	$1,187	$715	$4,812	1944	$4,574	$836	$900	$6,310
1926	3,371	1,219	721	5,311	1945	4,569	888	774	6,231
1927	2,875	1,201	622	4,698	1946	5,090	1,243	729	7,062
1928	2,666	1,163	655	4,484	1947	7,188	1,338	1,084	9,610
1929	2,940	1,166	802	4,908	1948	9,502	1,552	1,219	12,273
1930	2,500	973	507	3,980	1949	7,920	1,559	1,101	10,580
1931	1,620	671	287	2,578	1950	8,689	1,822	1,351	11,862
1932	1,460	412	128	2,000	1951	9,779	2,079	1,671	13,529
1933	1,413	432	205	2,050	1952	9,616	2,163	1,617	13,396
1934	1,947	520	277	2,744	1953	10,257	2,350	1,811	14,418
1935	2,013	564	365	2,942	1954	9,919	[3] 2,733	1,518	[3] 14,170
1936	2,405	685	516	3,606	1955	10,780	[3] 3,076	2,055	[3] 15,911
1937	2,798	711	756	4,265	1956	11,741	[3] 3,391	2,358	[3] 17,490
1938	2,436	622	460	3,518	1957	12,709	[3] 3,387	2,137	[3] 18,233
1939	2,423	754	631	3,808	1958	11,589	[3] 3,466	1,594	[3] 16,649
1940	2,662	784	752	4,198	1959	11,950	[3] 3,861	1,570	[3] 17,381
1941	3,228	989	890	5,107	1960	12,142	[3] 3,868	2,022	[3] 18,032
1942	3,568	1,056	999	5,623	1961	[3] 12,357	[3] 3,946	1,927	[3] 18,230
1943	4,028	916	987	5,931	1962	12,779	4,118	1,937	18,834

[1] Excludes Alaska and Hawaii, 1925–53.
[2] Data for 1925–46 are not strictly comparable with those for subsequent years, since for earlier years value of heavy clay products has not been replaced by value of raw clays used for such products.
[3] Revised figure.

[1] Statistical officer, Division of Minerals.

Because of inadequacies in the statistics available, some series deviate from the foregoing definition. The quantities of gold, silver, copper, lead, zinc, and tin are recorded on a mine basis (as the recoverable content of ore sold or treated). The values assigned to these quantities, however, are based on the average selling price of refined metal, not the mine value. Mercury is measured as recovered metal and valued at the average New York price for metal.

The weight or volume units shown are those customary in the particular industries producing the respective commodities. No adjustment has been made in dollar values for changes in purchasing power of the dollar.

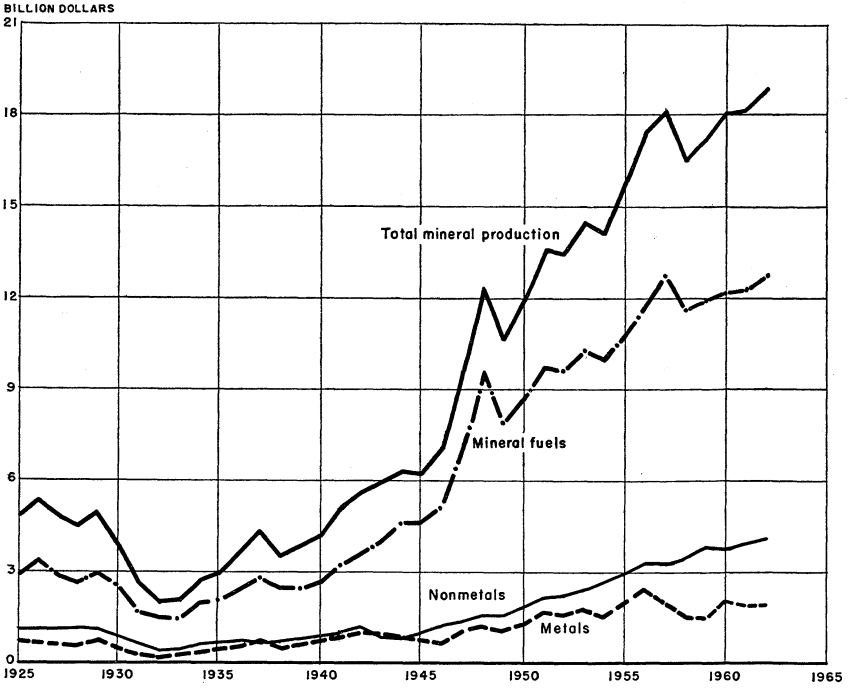

FIGURE 1.—Value of mineral production in the United States, 1925–62.

TABLE 2.—Mineral production [1] in the United States

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
Mineral fuels:								
Asphalt and related bitumens (native):								
Bituminous limestone and sandstone—short tons	1,518,765	$3,868	1,242,874	$3,070	1,558,792	$12,818	1,647,063	$14,601
Gilsonite—do	379,362	9,385	383,037	10,020				
Carbon dioxide, natural (estimate)—thousand cubic feet	485,179	71	521,169	99	545,354	82	1,144,107	146
Coal:								
Bituminous and lignite [2]—thousand short tons	412,028	1,965,607	415,512	1,950,425	402,977	1,844,563	422,149	1,891,553
Pennsylvania anthracite—do	20,649	172,320	18,817	147,116	17,446	140,338	16,894	134,094
Helium—thousand cubic feet	375,408	6,144	475,179	7,768	551,785	10 263	599,519	20,905
Natural gas—million cubic feet	12,046,115	1,556,800	12,771,038	1,789,970	13,254,025	1,996,241	13,876,622	2,145,301
Natural gas liquids:								
Natural gasoline and cycle products—thousand gallons	5,597,102	408,694	5 842,507	416,819	6,105,463	412 019	6,244,522	444,817
LP gases—do	7,874,706	349,802	8,444,074	391,566	9,085,465	370,186	9,409,083	353,334
Peat—short tons	419,460	4,372	470,889	5,138	[3] 531,067	[3] 5,036	571,873	5,186
Petroleum (crude)—thousand 42-gallon barrels	2 574,590	7,473,336	2,574,933	7,420,181	2,621,758	7,565,582	[4] 2,676,185	[4] 7,768,822
Total mineral fuels		11,950,000		12,142,000		12,357,000		12,779,000
Nonmetals (except fuels):								
Abrasive stone [5]—short tons	3,672	315	2,539	240	2,495	238	2,653	260
Aplite—long tons	(6)	(6)	(6)	(6)	97,465	651	125,156	912
Asbestos—short tons	45,459	4,391	45,223	4,231	52,814	4,347	53,190	4,677
Barite—do	901,815	10,301	714,276	8,574	796,804	[3] 9,300	860,312	9,820
Boron minerals—do	619,946	46,150	640,591	47,550	602,613	46,936	646,613	49,336
Bromine—thousand pounds	195,483	51,508	175,010	44,637	180,798	44,517	190,747	46,617
Cement:								
Portland—thousand 376-pound barrels	346,675	1,144,867	321,646	1,089,134	314,821	1,048,832	325,476	1,070,371
Masonry—thousand 280-pound barrels					19,275	55,737	19,998	57,405
Natural and slag—thousand 376-pound barrels					269	968	402	1,611
Clays—thousand short tons	49,383	159,659	49,069	162,411	47,389	156,829	47,797	163,012
Emery—short tons	8,555	150	8,169	142	6,180	106	4,316	71
Feldspar—long tons	548,390	5,372	502,380	4,779	496,808	5,120	492,476	5,076
Fluorspar—short tons	185,091	8,680	229,782	10,391	[3] 197,354	[3] 8,940	206,026	9,166
Garnet (abrasive)—do	14,568	1,211	10,522	986	12,057	1,036	14,166	1,172
Gem stones (estimate)	(7)	1,184	(7)	1,188	(7)	1,309	(7)	1,296
Gypsum—thousand short tons	10,900	39,231	9,825	35,690	9,500	[3] 34,996	9,969	36,343
Lime—do	12,498	163,890	12,935	172,731	[3] 13,249	[3] 177,463	13,753	186,754
Magnesite—short tons	594,307	2,401	498,528	2,051	603,656	3,129	492,471	2,287
Magnesium compounds from sea water and brine (except for metals) short tons, MgO equivalent	276,309	21,636	293,454	21,903	356,384	25,545	408,129	28,742

See footnotes at end of table.

TABLE 2.—Mineral production [1] in the United States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
Nonmetals (except fuels)—Continued								
Mica:								
Scrap—short tons	101,541	$2,665	97,912	$2,698	99,044	$2,417	107,702	$2,639
Sheet—pounds	706,395	3,419	[3] 587,401	[3] 3,198	[3] 526,007	[3] 3,386	360,958	1,277
Perlite—short tons	324,669	2,737	312,153	2,665	310,338	2,664	320,330	2,663
Phosphate rock—thousand long tons	15,869	98,758	17,516	117,041	18,559	130,535	19,382	134,304
Potassium salts—thousand short tons, K_2O equivalent	2,383	80,393	2,638	89,676	2,732	104,464	2,452	94,859
Pumice—thousand short tons	2,276	5,863	2,210	5,569	2,463	6,799	2,247	6,262
Pyrites—thousand long tons	1,057	8,148	1,016	7,936	988	7,418	916	6,809
Salt—thousand short tons	25,160	155,839	25,479	161,140	25,707	160,223	28,807	174,841
Sand and gravel—do	730,205	728,712	709,792	720,432	751,784	751,301	776,701	794,725
Sodium carbonate (natural)—short tons	735,261	19,078	808,624	20,865	805,828	20,444	977,584	24,330
Sodium sulfate (natural)—do	402,743	7,689	449,631	8,706	465,814	9,296	457,881	9,092
Stone [8]—thousand short tons	584,163	911,982	616,784	952,555	[3] 611,938	[3] 947,359	656,954	1,025,697
Sulfur:								
Frasch process mines—thousand long tons	5,222	121,777	5,003	115,494	5,082	117,884	4,917	107,069
Other mines—long tons	151,932	1,418	181,422	1,732	177,549	1,694	150,550	1,439
Talc, soapstone, and pyrophyllite—short tons	791,558	5,641	734,473	5,378	[3] 762,380	[3] 5,277	771,728	5,278
Tripoli—do	52,968	219	57,713	247	54,641	225	61,732	244
Vermiculite—thousand short tons	207	3,082	199	3,108	206	3,350	205	3,293
Value of items that cannot be disclosed: Brucite (1959), calcium-magnesium chloride, diatomite, epsom salts from epsomite (1961-62), graphite, iodine, kyanite, lithium minerals, greensand marl, olivine, staurolite (1960–62), strontium minerals (1959), wollastonite, and values indicated by footnote 6	----------	42,322	----------	42,664	----------	[3] 44,863	----------	47,815
Total nonmetals	----------	[3] 3,861,000	----------	[3] 3,868,000	----------	[3] 3,946,000	----------	4,118,000

Metals:								
Antimony ore and concentrate—short tons, antimony content	688	(9)	635	(9)	689	(9)	631	(9)
Bauxite—long tons, dried equivalent	1,700,235	17,725	1,997,827	21,107	1,228,032	13,937	1,369,007	15,609
Beryllium concentrate—short tons, gross weight	425	179	509	162	[10] 1,122	(9)	[10] 978	(9)
Chromite—do	[11] 105,000	[11] 3,765	[11] 107,000	[11] 3,813	[11] 82,000	[11] 2,939		
Cobalt (content of concentrate)—thousand pounds	2,944	(9)	(9)	(9)	(9)	(9)	(9)	(9)
Columbium-tantalum concentrate [12]—pounds	189,263	(9)						
Copper (recoverable content of ores, etc.)—short tons	824,846	506,455	1,080,169	693,468	1,165,155	699,093	1,228,421	756,707
Gold (recoverable content of ores, etc.)—troy ounces	1,602,931	56,103	1,666,772	58,336	1,548,270	54,189	1,542,511	53,990
Iron ore, usable (excluding byproduct iron sinter) thousand long tons, gross weight	59,164	514,067	82,963	724,131	72,378	650,501	69,969	618,242
Lead (recoverable content of ores, etc.)—short tons	255,586	58,786	246,669	57,722	261,921	53,956	236,956	43,602
Manganese ore (35 percent or more Mn)—short tons, gross weight	299,199	17,904	80,021	5,352	46,088	[3] 3,224	24,758	(9)
Manganiferous ore (5 to 35 percent Mn)—do	470,600	3,153	658,455	4,466	225,004	1,480	338,501	(9)
Mercury—76-pound flasks	31,256	7,110	33,223	7,002	31,662	6,257	26,277	5,024
Molybdenum (content of concentrate)—thousand pounds	51,603	64,655	69,941	87,406	66,753	87,925	50,506	69,390
Nickel (content or ore and concentrate)—short tons	13,374	(9)	14,079	(9)	13,133	(9)	13,110	(9)
Rare-earth and thorium concentrates—do	1,143	206	(9)	(9)	(9)	(9)	(9)	(9)
Silver (recoverable content of ores, etc.)—thousand troy ounces	31,194	28,233	30,766	27,846	34,794	32,166	36,798	39,929
Tin (content of ore and concentrate)—long tons	50	60	10	12	(9)	(9)	(9)	(9)
Titanium concentrate:								
Ilmenite—short tons, gross weight	637,263	12,106	789,237	14,655	782,629	13,320	809,037	13,974
Rutile—do	8,648	877	9,226	957	7,664	778	8,033	933
Tungsten ore and concentrate—short tons, 60 percent WO_3 basis	3,649	4,502	7,325	9,815	8,245	10,565	8,429	11,639
Uranium ore—short tons	6,934,927	141,349	7,970,211	152,188	8,041,329	148,299	7,052,870	138,294
Vanadium (recoverable in ore and concentrate)—do	3,719	13,278	4,971	17,749	5,343	19,076	[13] 5,211	[13] 18,605
Zinc (recoverable content of ores, etc.)—do	425,303	97,787	435,427	112,365	464,390	106,848	505,491	116,413
Value of items that cannot be disclosed: Chromite,[11] magnesium chloride for magnesium metal, manganiferous residuum, platinum-group metals (crude), zirconium concentrate, and values indicated by footnote 9		21,763		32,078		22,582		35,071
Total metals		1,570,000		2,022,000		1,927,000		1,937,000
Grand total mineral production		[3] 17,381,000		[3] 18,032,000		[3] 18,230,000		18,834,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Includes small quantity of anthracite mined in States other than Pennsylvania.
[3] Revised figure.
[4] Preliminary figure.
[5] Grindstones, pulpstones, millstones (weight not recorded), grinding pebbles, sharpening stones, and tube-mill liners.
[6] Figure withheld to avoid disclosing individual company confidential data; value included with "Nonmetal items that cannot be disclosed."
[7] Weight not recorded.
[8] Excludes abrasive stone, bituminous limestone, bituminous sandstone, and ground soapstone, all included elsewhere in table.
[9] Figure withheld to avoid disclosing individual company confidential data; value included with "Metal items that cannot be disclosed."
[10] Includes 805 tons of low-grade beryllium ore 1961, and 760 tons of low-grade beryllium ore 1962.
[11] Excludes quantity consumed by American Chrome Co.
[12] Total weight of columbite-tantalite plus $(Cb\text{-}Ta)_2O_5$ content of euxenite.
[13] Final figure, supersedes figure given in commodity chapter.

TABLE 3.—Minerals produced in the United States and principal producing States in 1962

Mineral	Principal producing States, in order of quantity	Other producing States
Antimony	Idaho	
Aplite	Va	
Asbestos	Vt., Calif., Ariz., N.C	Oreg.
Asphalt	Tex., Utah, Ala., Mo	
Barite	Mo., Ark., Nev., Ga	Calif., Idaho, Ky., Mont., N. Mex. S.C Tenn., Tex., Utah, Wash.
Bauxite	Ark., Ga., Ala	
Beryllium	S. Dak., N. Mex., Colo., N.H	Ariz., Conn., Maine, Utah, Wyo.
Boron	Calif	
Bromine	Mich., Tex., Ark., Calif	
Calcium-magnesium chloride.	Mich., Calif., W. Va	
Carbon dioxide	N. Mex., Colo., Utah, Calif	Wash.
Cement	Calif., Pa., Tex., Mich	Ala., Ariz., Ark., Colo., Fla., Ga., Hawaii, Idaho, Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Minn., Miss., Mo., Mont., Nebr., N. Mex., N.Y., Ohio, Okla., Oreg., S.C., S. Dak., Tenn., Utah, Va., Wash., W. Va., Wis., Wyo.
Clays	Ohio, Ga., Tex., Calif	All other States except Alaska and R.I.
Coal	W. Va., Pa., Ky., Ill	Ala., Alaska, Ark., Colo., Ga., Ind., Iowa, Kans., Md., Mo., Mont., N. Mex., N. Dak., Ohio, Okla., S. Dak., Tenn., Utah, Va., Wash., Wyo.
Cobalt	Pa	
Copper	Ariz., Utah, Mont., N. Mex	Calif., Colo., Idaho, Mich., Mo., Nev., N.C., Oreg., Pa., Tenn., Wash.
Diatomite	Calif., Nev., Wash., Ariz	Md., Oreg.
Emery	N.Y	
Feldspar	N.C., Calif., Conn., Ga	Ariz., Colo., Maine, N.H., S.C., Va.
Fluorspar	Ill., Ky., Colo., Mont	Nev., Utah.
Garnet, abrasive	N.Y., Idaho	
Gold	S. Dak., Utah, Alaska, Ariz	Calif., Colo., Idaho, Mont., Nev., N. Mex., N.C., Oreg., Pa., Tenn., Wash.
Graphite	Tex	
Gypsum	Calif., Mich., Iowa, Tex	Ariz., Ark., Colo., Ind., Kans., La., Mont., Nev., N. Mex., N.Y., Ohio, Okla., S. Dak., Utah, Va., Wyo.
Helium	Okla., Tex., Kans., N. Mex	
Iodine	Calif., Mich	
Iron ore	Minn., Mich., Ala., Calif	Ariz., Ark., Colo., Ga., Idaho, Mo., Mont., Nev., N.J., N. Mex., N.Y., N.C., Oreg., Pa., S. Dak., Tenn., Tex., Utah, Va., Wis., Wyo.
Kyanite	Va., S.C	
Lead	Idaho, Mo., Utah, Colo	Ariz., Calif., Ill., Kans., Ky., Mont., Nev., N. Mex., N.Y., N.C., Okla., Oreg., S. Dak., Tenn., Va., Wash., Wis.
Lime	Ohio, Mo., Mich., Pa	Ala., Ariz., Ark., Calif., Colo., Conn., Fla., Hawaii, Idaho., Ill., Iowa, Kans., La., Md., Mass., Minn., Miss., Mont., Nebr., Nev., N.J., N. Mex., N.Y., Okla., Oreg., S. Dak., Tenn., Tex., Utah, Vt., Va., Wash., W. Va., Wis., Wyo.
Lithium	N.C., Calif., S. Dak	
Magnesite	Nev., Wash	
Magnesium chloride	Tex	
Magnesium compounds	Mich., Calif., Fla., Tex	Miss., N.J.
Manganese ore	Mont	
Manganiferous ore	Minn., N. Mex., Mont., Calif	Ga.
Marl, greensand	N.J., Md	
Mercury	Calif., Nev., Alaska, Ariz	Oreg.
Mica:		
Scrap	N.C., Ala., Ga., S.C	Ariz., Calif., Colo., Conn., Maine, N.H., N. Mex., Pa., S. Dak.
Sheet	N.C., N.H., S. Dak., Maine	Ala., Conn., Ga., Idaho, Mont., N. Mex.
Molybdenum	Colo., Utah, Ariz., N. Mex	Calif., Nev.
Natural gas	Tex., La., Okla., N. Mex	Ala., Alaska, Ariz., Ark., Calif., Colo., Fla., Ill., Ind., Kans., Ky., Md., Mich., Miss., Mo., Mont., Nebr., N.Y., N. Dak., Ohio, Pa., Tenn., Utah, Va., W. Va., Wyo.
Natural gas liquids	Tex., La., Okla., Calif	Ark., Colo., Fla., Ill., Kans., Ky., Mich., Miss., Mont., Nebr., N. Mex., N. Dak., Pa., Utah, W. Va., Wyo.
Nickel	Oreg	
Olivine	Wash., N.C	

TABLE 3.—Minerals produced in the United States and principal producing States in 1962—Continued

Mineral	Principal producing States, in order of quantity	Other producing States
Peat	Mich., Ind., Wash., Calif.	Alaska, Colo., Conn., Fla., Ga., Idaho, Ill., Iowa, Maine, Md., Mass., Minn., Mont., N.J., N.Y., Ohio, Pa., S.C., Wis.
Perlite	N. Mex., Nev., Ariz., Calif.	Colo., Idaho, Oreg., Utah.
Petroleum	Tex., La., Calif., Okla.	Ala., Alaska, Ariz., Ark., Colo., Fla., Ill., Ind., Kans., Ky., Mich., Miss., Mo., Mont., Nebr., Nev., N. Mex., N.Y., N. Dak., Ohio, Pa., S. Dak., Tenn., Utah, Va., W. Va., Wyo.
Phosphate rock	Fla., Tenn., Idaho, Mont.	Utah, Wyo.
Platinum-group metals	Alaska, Calif.	
Potassium salts	N. Mex., Calif., Utah, Mich.	Md.
Pumice	Ariz., Calif., N. Mex., Hawaii.	Colo., Idaho, Nebr., Nev., Okla., Oreg., Tex., Utah, Wash., Wyo.
Pyrites	Tenn., Colo., Pa., Calif.	Ariz., S.C., Va.
Rare-earth metals	Calif., Fla., Mont.	
Salt	Tex., La., N.Y., Mich.	Ala., Calif., Colo., Hawaii, Kans., Nev., N. Mex., N. Dak., Ohio, Okla., Utah, Va., W. Va.
Sand and gravel	Calif., Mich., Ohio, Ill.	All other States.
Silver	Idaho, Ariz., Utah, Mont.	Alaska, Calif., Colo., Ky., Mich., Mo., Nev., N. Mex., N.Y., N.C., Oreg., Pa., S. Dak., Tenn., Wash.
Sodium carbonate	Wyo., Calif.	
Sodium sulfate	Calif., Tex., Wyo.	
Staurolite	Fla.	
Stone	Pa., Ill., Tex., Calif.	All other States.
Sulfur (Frasch)	Tex., La.	
Sulfur ore	Calif., Nev.	
Talc, soapstone, and pyrophyllite.	N.Y., Calif., N.C., Vt.	Ala., Ark., Ga., Md., Mont., Nev., Pa., Tex., Va., Wash.
Tin	Colo.	
Titanium	N.Y., Fla., Va., N.J.	Idaho.
Tripoli	Ill., Okla., Pa.	
Tungsten	Calif., N.C., Colo., Nev.	Ariz., Mont.
Uranium	N. Mex., Wyo., Colo., Utah.	Alaska, Ariz., Idaho, Mont., N. Dak., Oreg., S. Dak., Tex., Wash.
Vanadium	Colo., Ariz., Utah, Idaho.	N. Mex., S. Dak., Wyo.
Vermiculite	Mont., S.C., Wyo., Colo.	
Wollastonite	N.Y., Calif.	
Zinc	Tenn., Idaho, N.Y., Colo.	Ariz., Ark., Calif., Ill., Kans., Ky., Mo., Mont., Nev., N.J., N. Mex., Okla., Pa., Utah, Va., Wash., Wis.
Zirconium	Fla.	

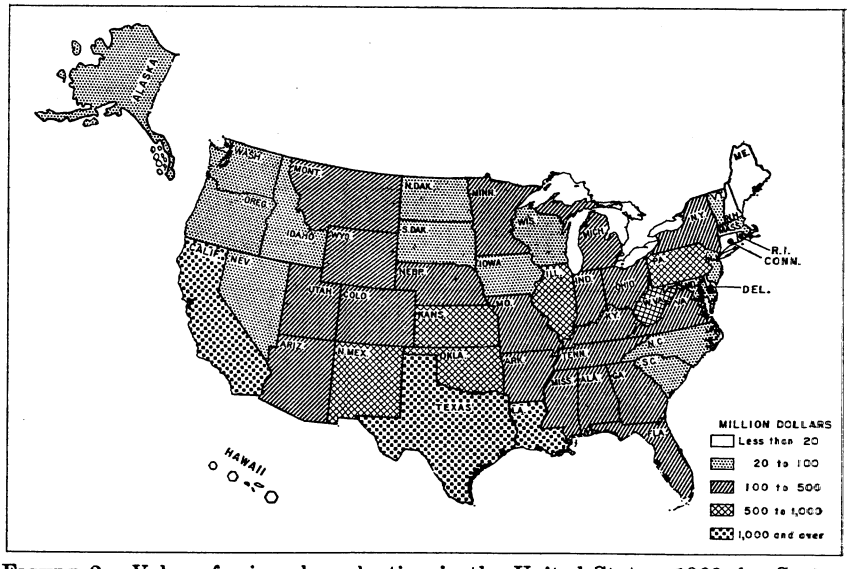

FIGURE 2.—Value of mineral production in the United States, 1962, by States.

TABLE 4.—Value of mineral production in the United States, and principal minerals produced in 1962

(Thousands)

State	1959	1960	1961	1962			
				Value	Rank	Percent of U.S. total	Principal minerals in order of value
Alabama	$206,456	$221,802	$218,879	$219,837	20	1.17	Coal, cement, stone, petroleum.
Alaska	20,495	21,860	34,753	54,196	39	.29	Petroleum, coal, gold, sand and gravel.
Arizona	328,245	417,225	425,995	474,142	11	2.52	Copper, sand and gravel, cement, zinc.
Arkansas	141,833	159,519	148,267	153,785	26	.82	Petroleum, stone, bauxite, sand and gravel.
California	1,450,876	1,422,087	1,435,737	1,467,295	3	7.79	Petroleum, natural gas, cement, sand and gravel.
Colorado	317,572	345,418	346,208	308,115	17	1.64	Petroleum, molybdenum, coal, sand and gravel.
Connecticut	13,030	15,353	16,599	19,754	45	.10	Sand and gravel, stone, lime, feldspar.
Delaware	1,284	989	1,053	1,531	50	.01	Sand and gravel, stone, clays, gem stones.
District of Columbia	75	71	68	74	----------	(1)	Clays.
Florida	167,130	180,286	188,121	185,697	24	.99	Phosphate rock, stone, cement, titanium concentrate.
Georgia	87,371	92,305	96,311	107,705	29	.57	Clays, stone, cement, sand and gravel.
Hawaii	7,644	9,367	14,990	14,844	47	.08	Stone, cement, sand and gravel, lime.
Idaho	70,392	57,606	69,034	82,575	33	.44	Silver, lead, zinc, sand and gravel.
Illinois	574,914	589,874	567,393	588,335	8	3.12	Petroleum, coal, stone, sand and gravel.
Indiana	209,145	210,932	201,545	202,330	22	1.07	Coal, cement, petroleum, stone.
Iowa	92,954	99,319	94,998	96,561	30	.51	Cement, stone, sand and gravel, gypsum.
Kansas	511,209	486,534	488,598	501,076	9	2.66	Petroleum, natural gas, cement, stone.
Kentucky	419,644	414,553	383,788	399,518	15	2.12	Coal, petroleum, stone, natural gas.
Louisiana	1,768,835	1,990,895	2,168,679	2,445,329	2	12.98	Petroleum, natural gas, natural gas liquids, sulfur.
Maine	13,739	14,108	15,615	14,947	46	.08	Cement, stone, sand and gravel, clays.
Maryland	55,190	57,697	62,858	66,629	36	.35	Stone, cement, sand and gravel, coal.
Massachusetts	26,686	28,245	30,789	30,035	43	.16	Sand and gravel, stone, lime, clays.
Michigan	388,545	437,598	450,652	446,520	12	2.37	Iron ore, cement, petroleum, copper.
Minnesota	347,367	515,521	450,914	428,936	13	2.28	Iron ore, sand and gravel, stone, cement.
Mississippi	186,678	199,210	208,580	209,428	21	1.11	Petroleum, natural gas, cement, sand and gravel.
Missouri	164,025	162,244	151,288	153,307	27	.81	Cement, stone, lime, coal.
Montana	168,099	179,406	184,233	190,656	23	1.01	Petroleum, copper, sand and gravel, zinc.
Nebraska	99,335	103,942	105,445	108,249	28	.57	Petroleum, cement, sand and gravel, stone.
Nevada	70,859	80,892	81,533	83,733	32	.44	Copper, sand and gravel, diatomite, lime.
New Hampshire	4,722	5,439	5,466	6,010	48	.03	Sand and gravel, stone, mica, feldspar.
New Jersey	59,544	56,469	59,270	65,686	37	.35	Stone, sand and gravel, iron ore, zinc.
New Mexico	592,812	653,766	690,913	674,064	7	3.58	Petroleum, natural gas, potassium salts, uranium.
New York	239,953	260,922	233,833	241,892	18	1.28	Cement, stone, salt, sand and gravel.
North Carolina	40,789	45,096	50,124	54,597	38	.29	Stone, sand and gravel, tungsten, feldspar.
North Dakota	67,342	78,378	84,925	90,572	31	.48	Petroleum, sand and gravel, coal, natural gas liquids.
Ohio	412,484	406,142	382,451	393,671	16	2.09	Coal, stone, cement, lime.
Oklahoma	768,390	782,579	791,777	843,272	4	4.48	Petroleum, natural gas, natural gas liquids, cement.
Oregon	50,849	55,772	53,092	52,458	40	.28	Stone, sand and gravel, cement, nickel.
Pennsylvania	879,693	838,146	805,127	823,152	5	4.37	Coal, cement, stone, iron ore.
Rhode Island	2,333	5,727	3,079	2,994	49	.02	Sand and gravel, stone, gem stones.

South Carolina	31,287	30,987	31,374	33,901	42	.18	Cement, stone, clays, sand and gravel.
South Dakota	49,498	47,675	44,007	45,789	41	.24	Gold, sand and gravel, cement, stone.
Tennessee	143,284	145,538	150,711	154,030	25	.82	Stone, cement, coal, phosphate rock.
Texas	4,230,107	4,126,419	4,237,958	4,300,984	1	22.84	Petroleum, natural gas, natural gas liquids, cement.
Utah	374,544	432,712	416,789	410,412	14	2.18	Copper, petroleum, uranium, coal.
Vermont	23,383	22,903	24,296	25,130	44	.13	Stone, asbestos, sand and gravel, talc.
Virginia	227,853	208,880	225,298	222,494	19	1.18	Coal, stone, cement, sand and gravel.
Washington	65,830	72,404	66,448	68,474	34	.36	Stone, sand and gravel, cement, zinc.
West Virginia	739,523	722,628	690,250	714,964	6	3.80	Coal, natural gas, natural gas liquids, petroleum.
Wisconsin	72,924	78,760	73,511	68,289	35	.36	Sand and gravel, stone, cement, iron ore.
Wyoming	394,372	439,256	466,247	485,777	10	2.60	Petroleum, natural gas, uranium, sodium carbonates and sulfates.
Total	17,381,000	18,032,000	18,230,000	18,834,000	----------	100.00	Petroleum, natural gas, coal, cement.

[1] Less than 0.005 percent

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TABLE 5.—Mineral production[1] in the United States by States

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
ALABAMA								
Cement:[2]								
Portland—thousand 376-pound barrels	14,819	$46,639	12,931	$42,706	12,445	$39,027	12,482	$40,164
Masonry—thousand 280-pound barrels					2,006	6,156	2,187	6,521
Clays[3]—thousand short tons	1,786	2,089	1,840	2,170	1,787	2,068	1,632	1,947
Coal (bituminous)—do	11,947	78,212	13,011	92,439	12,915	90,903	12,880	95,149
Iron ore (usable)—thousand long tons, gross weight	4,165	23,922	4,068	23,511	3,597	20,510	2,962	17,838
Lime—thousand short tons	579	6,847	536	6,593	579	6,871	522	6,298
Mica (sheet)—pounds	818	7	(5)	(5)	(4)	(4)	(4)	(5)
Natural gas—million cubic feet	172	17	57	4	56	4	128	13
Petroleum (crude)—thousand 42-gallon barrels	5,524	(6)	7,329	(4)	6,931	19,060	[6] 7,493	[6] 19,407
Sand and gravel—thousand short tons	4,352	4,594	4,359	4,759	5,800	6,452	4,655	4,486
Stone[7]—do	11,886	18,728	13,503	19,970	13,651	19,909	12,680	19,667
Value of items that cannot be disclosed: Native asphalt, bauxite, slag cement, clays (kaolin), scrap mica, salt, stone (dimension limestone, dimension marble 1959–61, shell 1959–61, crushed sandstone 1959–61), talc, and values indicated by footnote 4		25,401		29,650		7,919		8,347
Total		[6] 206,456		[6] 221,802		[6] 218,879		219,837
ALASKA								
Clays—thousand short tons	(9)	$1	1	$10				
Coal (bituminous)—do	660	5,869	722	6,318	737	$5,868	871	$6,409
Copper (recoverable content of ores, etc.)—short tons	36	22	41	26	92	55		
Gem stones		18		(4)		(4)	(10)	(4)
Gold (recoverable content of ores, etc.)—troy ounces	178,918	6,262	168,197	5,887	114,216	3,998	165,259	5,784
Mercury—76-pound flasks	3,743	852	4,459	940	4,129	816	3,719	711
Natural gas—million cubic feet	133	16	246	30	631	129	2,184	467
Peat—short tons			376	(4)			(4)	(4)
Petroleum (crude)—thousand 42-gallon barrels	187	295	559	1,230	6,327	17,652	[6] 10,260	[6] 31,190
Sand and gravel—thousand short tons	5,859	5,265	6,013	5,483	5,241	4,185	5,731	5,355
Silver (recoverable content of ores, etc.)—thousand troy ounces	21	19	26	23	18	17	22	24
Stone—thousand short tons	89	377	275	852	(4)	(4)	(4)	(4)
Value of items that cannot be disclosed: Lead (1960–61), platinum-group metals, uranium ore, and values indicated by footnote 4		1,499		1,061		[6] 2,033		4,256
Total		20,495		21,860		[6] 34,753		54,196

Beryllium concentrate—short tons, gross weight			(11)	(8)	8	$4	1	(8)
Clays [9]—thousand short tons	120	$179	173	$260	165	240	139	$184
Coal (bituminous)—do	7	63	6	58				
Copper (recoverable content of ores, etc.)—short tons	430,297	264,202	538,605	345,784	587,053	352,232	644,242	396,853
Gem stones	(10)	88	(10)	120	(10)	119	(10)	120
Gold (recoverable content of ores, etc.)—troy ounces	124,627	4,362	143,064	5,007	145,959	5,109	137,207	4,802
Lead (recoverable content of ores, etc.)—short tons	9,999	2,300	8,495	1,988	5,937	1,223	6,966	1,282
Lime—thousand short tons	123	1,666	148	2,430	167	2,686	174	2,914
Manganese ore (35 percent or more Mn)—short tons, gross weight	68,183	5,727	1,626	40				
Manganiferous ore (5 to 35 percent Mn)—do	10,693	234	8,677	190	(4)	(4)		
Mercury—76-pound flasks	(4)	(4)	(4)	(4)	148	29	(4)	(4)
Mica (scrap)—short tons	3,069	55	(4)	(4)	(4)	(4)	(4)	(4)
Molybdenum (content of concentrate)—thousand pounds	3,181	4,019	4,359	5,211	4,878	6,232	4,412	5,864
Natural gas—million cubic feet							230	27
Perlite—short tons	(4)	(4)	(4)	(4)	(4)	(4)	17,749	147
Petroleum (crude)—thousand 42-gallon barrels	25	(4)	73	(4)	73	(4)	[6] 43	(4)
Pumice—thousand short tons	487	1,153	703	1,164	745	1,893	756	1,640
Sand and gravel—do	13,458	11,966	14,490	14,235	[8] 17,688	[8] 16,175	15,579	17,404
Silver (recoverable content of ores, etc.)—thousand troy ounces	3,898	3,528	4,775	4,322	5,120	4,733	5,454	5,917
Stone—thousand short tons	2,468	3,998	4,249	5,107	3,582	4,626	4,333	6,616
Tungsten ore and concentrate—short tons, 60-percent WO_3 basis	(4)	(4)	(4)	(4)			15	14
Uranium ore—short tons	253,390	6,309	283,684	6,219	228,225	4,965	143,196	3,047
Vanadium (recoverable in ore and concentrate)—do	(4)	(4)	(4)	(4)	(4)	(4)	632	(4)
Zinc (recoverable content of ores, etc.)—do	37,325	8,585	35,811	9,239	29,585	6,804	32,888	7,564
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite, fire clay 1961–62), diatomite (1961–62), feldspar, gypsum, helium (1961–62), iron ore (1961–62), pyrites, and values indicated by footnote 4		9,811		[8] 15,851		[8] 18,925		19,747
Total		[8] 328,245		[8] 417,225		[8] 425,995		474,142

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
ARKANSAS								
Barite—short tons	338,539	$3,097	277,851	$2,578	277,855	$2,630	258,691	$2,232
Bauxite—long tons, dried equivalent	1,631,643	17,048	1,932,071	20,469	1,178,898	13,462	1,270,124	14,606
Clays—thousand short tons	782	2,406	815	2,456	773	1,758	654	1,693
Coal (bituminous)—do	441	3,482	409	3,116	395	2,888	256	1,809
Gem stones	[10]	18	[10]	38	[10]	19	[10]	15
Gypsum—thousand short tons	[4]	[4]	67	208	167	531	83	261
Iron ore (usable)—thousand long tons, gross weight							43	296
Lead (recoverable content of ores, etc.)—short tons	38	9						
Lime—thousand short tons	[4]	[4]	[4]	[4]	[5] 90	[5] 1,196	350	4,542
Manganese ore (35 percent or more Mn)—short tons, gross weight	17,742	1,398						
Natural gas—million cubic feet	40,674	3,539	55,451	6,599	59,547	8,039	66,213	9,866
Natural gas liquids:								
Natural gasoline and cycle products—thousand gallons	40,730	2,523	34,558	2,148	27,889	1,640	29,415	1,673
LP gases—do	55,731	3,048	73,252	3,735	75,157	3,286	69,452	2,432
Petroleum (crude)—thousand 42-gallon barrels	26,329	72,931	30,117	83,424	29,246	80,427	[6] 27,585	[6] 73,376
Sand and gravel—thousand short tons	11,696	11,857	8,192	10,262	9,389	9,074	10,847	10,006
Stone—do	8,824	10,424	10,939	13,555	12,029	12,402	20,611	19,866
Zinc (recoverable content of ores, etc.)—short tons	49	11	50	13	37	9	211	49
Value of items that cannot be disclosed: Abrasive stones, bromine, cement, soapstone, and values indicated by footnote 4		10,042		10,918		10,906		11,063
Total		[8] 141,833		[8] 159,519		[8] 148,267		153,785

Barite	short tons	28,143	$326	16,157	$181	21,203	$295	6,945	$133
Boron minerals	do	619,946	46,150	640,591	47,550	602,613	46,936	646,613	49,336
Cement	thousand 376-pound barrels	[2] 43,635	[2] 138,506	[2] 39,712	[2] 128,826	[2] 41,090	[2] 129,836	43,667	139,151
Clays	thousand short tons	2,726	5,646	2,899	5,663	3,041	6,405	3,137	7,349
Copper (recoverable content of ores, etc.)	short tons	663	407	1,087	698	1,382	829	1,162	716
Feldspar	long tons	76,489	824	76,010	886	(4)	(4)	(4)	(4)
Gem stones		(10)	150	(10)	150	(10)	200	(10)	200
Gold (recoverable content of ores, etc.)	troy ounces	145,270	5,084	123,713	4,330	97,644	3,418	106,272	3,720
Gypsum	thousand short tons	1,686	3,788	1,616	3,687	1,574	[3] 3,733	1,747	4,113
Lead (recoverable content of ores, etc.)	short tons	227	52	440	103	103	21	455	84
Lime	thousand short tons	358	5,817	345	5,628	[3] 503	[3] 9,062	470	8,454
Magnesium compounds from sea water and bitterns (partly estimated) short tons, MgO equivalent		87,968	6,336	86,532	6,233	90,534	6,467	76,445	6,077
Manganese ore (35 percent or more Mn)	short tons, gross weight	19,354	1,663						
Manganiferous ore (5 to 35 percent Mn)	do	129	(4)	96	(4)			(4)	(4)
Mercury	76-pound flasks	17,100	3,890	18,764	3,955	18,688	3,693	15,951	3,050
Mica, scrap	short tons			(4)	(4)	950	12	(4)	(4)
Natural gas	million cubic feet	485,655	119,471	517,535	138,182	556,241	157,416	564,220	163,624
Natural gas liquids:									
Natural gasoline and cycle products	thousand gallons	834,258	68,023	794,657	62,496	762,878	57,645	716,904	54,460
LP gases	do	396,331	21,260	408,378	21,482	424,767	21,805	407,378	19,294
Peat	short tons	34,604	449	33,091	481	46,348	501	33,901	331
Petroleum (crude)	thousand 42-gallon barrels	308,946	787,812	305,352	751,166	299,609	728,050	[6] 296,572	[6] 741,430
Pumice	thousand short tons	574	2,162	427	1,895	610	2,202	573	2,615
Salt	do	1,388	(4)	1,443	(4)	1,601	(4)	1,643	(4)
Sand and gravel	do	87,945	108,909	87,679	107,503	110,181	124,111	107,660	124,922
Silver (recoverable content of ores, etc.)	thousand troy ounces	173	156	180	163	93	86	133	144
Stone	thousand short tons	32,134	49,090	33,075	49,842	33,850	5,327	34,776	54,722
Talc, soapstone, and pyrophyllite	short tons	144,816	1,490	130,539	1,396	161,068	1,524	117,912	1,339
Wollastonite	do	(4)	(4)	(4)	(4)	4,075	42	(4)	(4)
Zinc (recoverable content of ores, etc.)	do	78	18	465	120	304	70	322	74
Value of items that cannot be disclosed: Asbestos, bromine, calcium-magnesium chloride, carbon dioxide, masonry cement (1959–61), chromite (1959), coal (lignite), diatomite, fluorspar (1960–61), iodine, iron ore, lithium minerals, magnesite (1959–61), molybdenum, perlite, platinum-group metals (crude), potassium salts, pyrites, rare-earth metal concentrates, sodium cabonates and sulfates, strontium minerals (1959), sulfur ore, tungsten concentrate, uranium ore (1959–60), and values indicated by footnote 4			73,397		79,471		81,051		81,957
Total			[5] 1,450,876		[5] 1,422,087		[5] 1,435,737		1,467,295

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
COLORADO								
Beryllium concentrate—short tons, gross weight	221	$67	304	$53	[12] 819	(4)	[12] 782	(4)
Carbon dioxide, natural—thousand cubic feet	175,223	(4)	155,871	20	167,872	$19	148,940	$15
Clays—thousand short tons	417	1,160	490	1,424	556	1,241	802	1,573
Coal (bituminous)—do	3,294	21,034	3,607	21,090	3,678	22,787	3,379	19,999
Copper (recoverable content of ores, etc.)—short tons	2,940	1,805	3,247	2,085	4,141	2,485	4,534	2,793
Feldspar—long tons	(4)	(4)	(4)	(4)	14,129	99	(4)	(4)
Gem stones	(10)	43	(10)	45	(10)	36	(10)	45
Gold (recoverable content of ores, etc.)—troy ounces	61,097	2,138	61,269	2,144	67,515	2,363	48,882	1,711
Gypsum—thousand short tons	106	385	82	296	85	320	108	383
Iron ore (usable)—thousand long tons, gross weight	11	78	11	80	27	190	(4)	(4)
Lead (recoverable content of ores, etc.)—short tons	12,907	2,969	18,080	4,231	17,755	3,658	17,411	3,204
Lime—thousand short tons	(4)	(4)	(4)	(4)	75	1,319	93	1,518
Manganese ore (35 percent or more Mn)—short tons, gross weight	1,218	102						
Mica, scrap—short tons	68	1	340	4	600	10	142	2
Molybdenum (content of concentrate)—thousand pounds	36,745	46,555	51,615	65,448	47,485	63,582	32,412	45,376
Natural gas—million cubic feet	99,899	10,989	107,404	12,781	108,142	12,544	101,826	11,812
Natural gas liquids:								
Natural gasoline—thousand gallons	47,424	2,811	73,179	4,138	76,880	3,627	60,558	3,826
LP gases—do	77,637	3,671	104,275	4,938	115,410	5,498	100,787	4,411
Peat—short tons	6,674	35	9,384	37	9,894	44	12,351	68
Petroleum (crude)—thousand 42-gallon barrels	46,440	134,676	47,469	137,660	46,759	134,666	[6] 42,460	[6] 122,285
Pumice—thousand short tons	40	66	32	70	44	60	76	82
Rare-earth and thorium concentrates—short tons	9	1	(11)	(5)				
Sand and gravel—thousand short tons	20,897	18,817	19,053	16,882	18,360	16,946	19,313	18,926
Silver (recoverable content of ores, etc.)—thousand troy ounces	1,341	1,213	1,659	1,502	1,965	1,817	2,088	2,265
Stone—thousand short tons	2,824	5,537	2,442	4,651	2,451	5,301	2,353	5,597
Tin (content of ore and concentrate)—long tons	50	60	10	12	(4)	(4)	(4)	(4)
Uranium ore—short tons	1,044,089	22,546	1,149,583	23,462	1,282,462	21,509	1,135,440	18,044
Vanadium (recoverable in ore and concentrate)—do	2,949	(4)	4,026	(4)	4,149	(4)	3,742	(4)
Zinc (recoverable content of ores, etc.)—do	35,388	8,139	31,278	8,070	42,647	9,809	43,351	9,971
Value of items that cannot be disclosed: Cement, fluorspar, perlite, pyrites, salt, tungsten, vermiculite (1962), and values indicated by footnote 4		[8] 32,674		[8] 34,295		[8] 36,278		34,209
Total		[8] 317,572		[8] 345,418		[8] 346,208		308,115

CONNECTICUT

Beryllium concentrate	short tons, gross weight	13	$8	16	$9	2	$1	7	$4
Clays	thousand short tons	280	368	207	308	[3] 149	[3] 260	[3] 179	[3] 287
Gem stones		[10]	5	[10]	7	[10]	9	[10]	8
Lime	thousand short tons	[4]	[4]	35	616	33	589	35	635
Peat	short tons	2,090	13	[4]	[4]	[4]	[4]	[4]	[4]
Sand and gravel	thousand short tons	4,749	4,912	6,575	5,960	7,499	6,633	10,208	9,244
Stone	do	4,462	7,088	5,057	8,313	5,206	8,616	5,090	8,816
Value of items that cannot be disclosed: Clays (kaolin 1961–62) feldspar, scrap mica (1961–62), sheet mica (1960–62), and values indicated by footnote 4			636		140		491		760
Total			[3] 13,030		[3] 15,353		[3] 16,599		19,754

DELAWARE

Sand and gravel	thousand short tons	1,241	$1,071	1,084	$907	961	$970	1,755	$1,445
Value of items that cannot be disclosed: Nonmetals			213		82		83		86
Total			1,284		989		1,053		1,531

FLORIDA

Clays	thousand short tons	[3] 245	[3] $6,171	[3] 252	[3] $6,357	513	$7,202	487	$6,741
Gem stones		[10]	3	[10]	[5]	[10]	[5]		
Lime	thousand short tons	111	1,238	151	2,611	[4]	[4]	[4]	[4]
Natural gas	million cubic feet	34	5	30	5	29	5	29	6
Peat	short tons	34,446	158	39,275	162	[3] 26,673	[3] 157	21,592	138
Petroleum (crude)	thousand 42-gallon barrels	424	[4]	369	[4]	374	[4]	[3] 418	[4]
Phosphate rock	thousand long tons	11,564	71,208	12,321	82,530	13,789	95,590	13,949	94,595
Sand and gravel	thousand short tons	6,674	5,177	6,757	5,559	6,530	5,577	5,924	5,179
Stone	do	[7] 26,917	[7] 35,940	[7] 27,629	[7] 37,419	[7] 26,221	[7] 33,671	27,279	32,608
Titanium concentrate	thousand short tons, gross weight	262	7,196	286	7,489	[4]	[4]	[4]	[4]
Value of items that cannot be disclosed: Cement, clays (kaolin and miscellaneous clay 1959–60), magnesium compounds, natural gas liquids (1962), rare-earth metals concentrates (1959, 1961–62), staurolite, stone (dimension limestone 1959, 1961, calcareous marl 1960), zirconium concentrate, and values indicated by footnote 4			40,034		38,154		[3] 45,919		46,430
Total			[3] 167,130		[3] 180,286		[3] 188,121		185,697

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
GEORGIA								
Barite—short tons	(4)	(4)	(4)	(4)	106,914	$2,046	108,829	$1,987
Clays—thousand short tons	3,352	$36,232	3,519	$40,160	3,569	42,025	3,801	47,462
Coal (bituminous)—do	7	34	4	21	4	22	8	28
Feldspar—long tons	(4)	(4)	(4)	(4)	31,128	692	35,692	795
Iron ore (usable)—thousand long tons, gross weight	186	945	128	613	162	835	215	1,118
Manganese ore (35 percent or more Mn)—short tons, gross weight	1,547	(4)						
Mica (sheet)—pounds	18,461	119	10,218	89	349	3	60	1
Peat—short tons	4,288	(4)	6,904	73	[5] 1,914	(4)	(4)	(4)
Sand and gravel—thousand short tons	2,909	2,982	3,338	3,047	3,150	3,049	3,429	3,365
Stone—do	13,771	35,973	14,297	37,033	15,854	38,077	19,555	42,037
Talc and soapstone—short tons	53,692	107	40,200	88	47,950	98	45,940	96
Value of items that cannot be disclosed: Bauxite, cement, gem stones, iron ore (pigment material, 1959–60), manganiferous ore, scrap mica, and values indicated by footnote 4		10,979		11,181		[5] 9,464		10,816
Total		[5] 87,371		[5] 92,305		[5] 96,311		107,705
HAWAII								
Cement—thousand 376-pound barrels			113	$571	1,077	$5,574	1,128	$6,055
Gem stones	(10)	(4)	(10)	(4)	(10)	18	(10)	(4)
Lime—thousand short tons	(4)	(4)	(4)	(4)	14	354	15	386
Pumice—do	276	$548	361	676	324	626	232	380
Salt—do					(9)	4	(9)	(4)
Sand and gravel—do	463	1,253	490	1,324	416	758	700	1,122
Stone—do	3,034	5,480	3,535	6,443	4,429	7,656	4,071	6,883
Value of items that cannot be disclosed: Other nonmetals and values indicated by footnote 4		363		353				18
Total		[5] 7,644		[5] 9,367		[5] 14,990		14,844

IDAHO

Antimony ore and concentrate—short tons, antimony content	678	(4)	635	(4)	689	(4)	631	(4)
Clays—thousand short tons	[3] 39	[3] $33	[3] 36	[3] $29	[3] 27	[3] $20	35	$70
Cobalt (content of concentrate)—thousand pounds	1,141	(4)						
Columbium-tantalum concentrate—pounds	189,263	(4)						
Copper (recoverable content of ores, etc.)—short tons	8,713	5,350	4,208	2,702	4,328	2,597	3,861	2,378
Gold (recoverable content of ores, etc.)—troy ounces	10,479	367	6,135	215	5,718	200	5,845	205
Iron ore (usable)—thousand long tons, gross weight	6	56	9	(4)	12	70	5	35
Lead (recoverable content of ores, etc.)—short tons	62,395	14,351	42,907	10,040	71,476	14,724	84,058	15,467
Lime—thousand short tons					47	658	68	801
Mercury—76-pound flasks	1,961	446	1,538	324	1,073	212		
Phosphate rock—thousand long tons	1,610	7,412	2,177	11,044	1,440	7,984	1,912	10,635
Pumice—thousand short tons	93	137	56	88	60	95	43	64
Rare-earth metals concentrates—short tons	522	80						
Sand and gravel—thousand short tons	9,184	8,080	7,088	6,594	7,305	6,793	14,321	13,029
Silver (recoverable content of ores, etc.)—thousand troy ounces	16,637	15,057	13,647	12,351	17,576	16,249	17,772	19,283
Stone—thousand short tons	1,079	1,931	1,318	2,141	1,873	3,111	1,381	2,698
Titanium concentrate—short tons, gross weight	(4)	(4)	2,014	30	1,873	28	(4)	(4)
Uranium ore—short tons	3,374	30	(4)	(4)	(4)	(4)	(4)	(4)
Zinc (recoverable content of ores, etc.)—do	55,699	12,811	36,801	9,495	58,295	13,408	62,865	14,459
Value of items that cannot be disclosed: Barite, cement, clays (fire clay 1959–61, bentonite 1960–61, kaolin 1961), abrasive garnet, gem stones, gypsum (1959), sheet mica (1959–60, 1962), nickel (1959), peat, perlite (1961–62), tungsten concentrate (1961), vanadium (1961–62), and values indicated by footnote 4		[3] 4,251		[3] 2,553		[3] 2,885		3,451
Total		[3] 70,392		[3] 57,606		[3] 69,034		82,575

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
ILLINOIS								
Cement:								
Portland—thousand 376-pound barrels	9,925	$31,794	9,139	$30,732	8,595	$28,301	9,145	$30,205
Masonry—thousand 280-pound barrels					461	1,420	440	1,320
Clays—thousand short tons	2,229	4,950	2,357	5,479	1,982	4,166	1,929	4,151
Coal (bituminous)—do	45,466	184,412	45,977	184,087	45,246	177,070	48,487	186,986
Fluorspar—short tons	112,469	5,908	134,529	6,936	116,908	5,956	132,830	6,392
Gem stones	(10)	1	(10)	(4)	(10)	(4)	(10)	(4)
Lead (recoverable content of ores, etc.)—short tons	2,570	591	3,000	702	3,430	707	3,610	664
Natural gas—million cubic feet	13,739	1,910	11,666	1,458	9,970	1,276	10,650	1,523
Natural gas liquids:								
Natural gasoline and cycle products—thousand gallons	(4)	(4)	16,496	1,313	16,956	1,311	13,315	1,023
LP gases—do	(4)	(4)	358,366	19,941	340,284	16,495	327,616	13,812
Peat—short tons	9,117	72	6,179	28	6,597	30	(4)	(4)
Petroleum (crude)—thousand 42-gallon barrels	76,727	229,414	77,341	228,929	76,818	229,686	[6] 77,325	[6] 230,429
Sand and gravel—thousand short tons	30,241	33,717	33,138	36,255	31,353	35,098	34,122	38,981
Stone—do	35,294	45,081	41,721	55,593	36,361	47,939	41,293	54,411
Zinc (recoverable content of ores, etc.)—short tons	26,815	6,167	29,550	7,624	26,795	6,163	27,413	6,305
Value of items that cannot be disclosed: Lime, tripoli, and values indicated by footnote 4		30,897		10,797		11,775		12,133
Total		[8] 574,914		[8] 589,874		[8] 567,393		588,335
INDIANA								
Abrasive stones—short tons	5	$13	(4)	(4)	5	$14	5	$15
Cement [3]—thousand 376-pound barrels	14,245	47,231	14,052	$48,310	13,780	47,024	12,878	42,572
Clays—thousand short tons	1,692	2,915	1,822	3,396	1,362	2,446	1,450	2,255
Coal (bituminous)—do	14,804	59,954	15,538	61,570	15,106	58,815	15,709	60,079
Natural gas—million cubic feet	484	92	342	61	382	77	284	60
Peat—short tons	15,393	202	27,486	290	57,146	502	51,710	272
Petroleum (crude)—thousand 42-gallon barrels	11,554	34,315	12,054	35,439	11,500	34,270	[6] 11,709	[6] 34,893
Sand and gravel—thousand short tons	20,357	17,924	20,752	18,377	19,577	16,898	21,261	18,692
Stone—do	18,544	37,682	18,956	34,920	18,001	33,062	18,709	34,653
Value of items that cannot be disclosed: Cement (masonry 1959–61), gem stones (1961–62), gypsum, and values indicated by footnote 4		8,817		8,569		[8] 8,437		8,839
Total		[8] 209,145		[8] 210,932		[8] 201,545		202,330

IOWA

Cement:								
Portland—thousand 376-pound barrels	13,170	$44,048	12,517	$44,204	12,108	$41,718	12,261	$42,417
Masonry—thousand 280-pound barrels					557	1,843	568	1,786
Clays—thousand short tons	912	1,168	1,022	1,345	1,044	1,426	1,039	1,427
Coal (bituminous)—do	1,180	4,214	1,068	3,845	927	3,323	1,130	4,026
Gypsum—do	1,318	5,587	1,283	5,428	1,239	5,276	1,256	5,318
Sand and gravel—do	13,484	11,658	14,692	13,516	13,391	11,651	13,797	12,474
Stone—do	20,501	25,759	23,185	30,321	22,018	28,916	21,618	28,244
Value of items that cannot be disclosed: Gem stones (1960–62), lime, and peat (1960–62)		520		660		845		869
Total		92,954		[8] 99,319		[8] 94,998		96,561

KANSAS

Cement:								
Portland—thousand 376-pound barrels	10,405	$32,282	8,162	$26,373	8,028	$25,605	8,058	$25,134
Masonry—thousand 280-pound barrels					379	1,156	392	1,156
Clays—thousand short tons	1,021	1,271	894	1,224	954	1,225	895	1,091
Coal (bituminous)—do	772	3,607	888	4,197	664	3,102	915	4,249
Gem stones	[10]	1	[10]	[5]				
Helium—thousand cubic feet	21,643	343	21,696	350	23,251	434	42,305	1,478
Lead (recoverable content of ores, etc.)—short tons	481	111	781	183	1,449	298	970	178
Lime—thousand short tons					15	193	5	59
Natural gas—million cubic feet	604,410	72,529	634,410	74,226	649,083	81,135	694,352	86,100
Natural gas liquids:								
Natural gasoline—thousand gallons	107,814	5,576	115,868	6,694	132,180	5,790	151,360	7,696
LP gases—do	124,874	6,658	127,270	6,343	135,643	5,916	166,769	6,295
Petroleum (crude)—thousand 42-gallon barrels	119,543	347,870	113,453	329,014	112,241	324,376	[6] 112,076	[6] 326,141
Salt—thousand short tons	1,123	13,670	1,213	14,109	[13] 913	[13] 11,409	[13] 944	[13] 11,654
Sand and gravel—do	11,334	7,937	9,710	6,808	11,366	7,781	11,552	8,039
Stone [7]—do	13,999	17,108	11,814	15,031	12,328	16,411	13,527	17,274
Zinc (recoverable content of ores, etc.)—short tons	1,017	234	2,117	546	2,446	563	3,943	907
Value of items that cannot be disclosed: Natural cement, gypsum, pumice, salt (brine 1961–62), and stone (dimension sandstone 1959 and crushed sandstone)		2,012		1,436		3,204		3,625
Total		[8] 511,209		[8] 486,534		[8] 488,598		501,076

See footnotes at end of table

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
KENTUCKY								
Barite—short tons	26,598	$335	(4)	(4)	3,304	$30	4,097	$36
Clays—thousand short tons	984	3,595	[3] 951	[3] $2,646	[3] 906	[3] 2,406	[3] 936	[3] 2,158
Coal (bituminous)—do	62,810	270,139	66,846	282,395	63,032	256,158	69,212	270,875
Fluorspar—short tons	18,579	887	25,855	1,173	[5] 31,169	[5] 1,420	33,830	1,492
Lead (recoverable content of ores, etc.)—do	409	94	558	131	656	135	743	137
Natural gas—million cubic feet	73,504	17,420	75,329	18,380	70,937	17,592	70,241	17,419
Natural gas liquids:								
Natural gasoline—thousand gallons	35,868	2,133	(4)	(4)	(4)	(4)	(4)	(4)
LP gases—do	213,171	12,267	(4)	(4)	(4)	(4)	(4)	(4)
Petroleum (crude)—thousand 42-gallon barrels	27,272	76,634	21,147	60,268	18,344	54,482	[6] 18,122	[6] 53,460
Sand and gravel—thousand short tons	5,081	5,568	5,113	5,763	5,582	5,540	6,137	5,378
Silver (recoverable content of ores, etc.)—thousand troy ounces	(4)	(4)			2	2	1	2
Stone—thousand short tons	[7] 16,063	[7] 22,215	[7] 15,810	[7] 21,493	17,085	23,309	19,472	27,682
Zinc (recoverable content of ores, etc.)—short tons	673	155	869	224	1,147	264	1,172	270
Value of items that cannot be disclosed: Cement, ball clay (1960–62), gem stones (1960–62), stone (crushed sandstone 1959–60), and values indicated by footnote 4		8,202		22,080		[8] 22,450		20,609
Total		[8] 419,644		[8] 414,553		[8] 383,788		399,518
LOUISIANA								
Clays—thousand short tons	[3] 904	[3] $904	749	$749	645	$645	638	$641
Lime—do	(4)	(4)	(4)	(4)	[8] 636	[8] 6,292	624	6,519
Natural gas—million cubic feet	2,670,271	411,222	2,988,414	511,019	3,271,857	611,837	3,525,456	694,515
Natural gas liquids:								
Natural gasoline and cycle products—thousand gallons	846,110	60,295	875,567	66,214	931,176	61,714	1,010,137	74,726
LP gases—do	540,046	25,877	606,023	28,147	806,559	33,214	862,772	29,037
Petroleum (crude)—thousand 42-gallon barrels	362,666	1,145,569	400,832	1,258,138	424,962	1,338,160	[6] 483,101	[6] 1,521,274
Salt—thousand short tons	4,807	20,918	4,792	21,959	4,722	23,357	5,248	27,407
Sand and gravel—do	16,052	20,111	14,319	19,106	12,042	14,833	12,040	14,817
Stone—do	5,670	10,874	[7] 4,691	[7] 8,882	[7] 4,641	[7] 7,656	[7] 5,711	[7] 8,067
Sulfur (Frasch process)—thousand long tons	2,252	52,779	2,256	52,639	2,352	55,164	2,262	49,772
Value of items that cannot be disclosed: Cement, clay (bentonite 1959), gypsum, stone (crushed miscellaneous 1960–62), and values indicated by footnote 4		20,286		24,042		15,807		18,554
Total		[8] 1,768,835		[8] 1,990,895		[8] 2,168,679		2,445,329

MAINE

Beryllium concentrate	short tons, gross weight	3	$2	(4)	(4)	5	$3	(4)	(4)
Clays	thousand short tons	25	26	41	$50	43	51	48	$63
Gem stones		(10)	10	(10)	15	(10)	20	(10)	25
Mica:									
Scrap	short tons	157	4	171	6	80	2	15	(5)
Sheet	pounds	22,360	237	$28,860	303	$9,680	88	2,017	16
Peat	short tons	(4)	(4)					3,050	47
Sand and gravel	thousand short tons	9,452	3,644	9,833	3,892	8,921	3,796	10,014	4,013
Stone	do	819	2,766	1,012	3,851	998	4,694	1,127	4,249
Value of items that cannot be disclosed: Cement, feldspar, and values indicated by footnote 4			7,050		5,991		6,961		6,534
Total			$13,739		$14,108		$15,615		14,947

MARYLAND

Clays	thousand short tons	$661	$944	$612	$853	581	$997	593	$899
Coal (bituminous)	do	842	3,188	748	2,799	757	2,868	821	3,168
Gem stones		(10)	2	(10)	2	(10)	3	(10)	3
Natural gas	million cubic feet	4,373	1,181	4,065	1,081	3,578	973	2,472	667
Sand and gravel	thousand short tons	10,034	12,983	10,076	13,221	12,404	16,894	12,762	16,816
Stone	do	7,445	15,476	7,944	16,962	$10,007	$20,373	11,610	22,595
Value of items that cannot be disclosed: Cement, ball clay (1959–60), diatomite (1962), lime, greensand marl, peat (1961–62), potassium salts, and talc and soapstone			21,416		22,779		$20,750		22,481
Total			$55,190		$57,697		$62,858		66,629

MASSACHUSETTS

Clays	thousand short tons	101	$229	83	$71	104	$85	125	$96
Gem stones		(10)	1	(10)	1	(10)	2	(10)	2
Lime	thousand short tons	144	2,289	154	2,370	145	2,307	148	2,337
Peat	short tons	773	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Sand and gravel	thousand short tons	13,210	11,786	14,789	13,013	18,061	14,958	17,566	15,026
Stone	do	5,102	12,375	5,247	12,782	5,210	13,399	4,985	12,541
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 4			6		8		38		33
Total			$26,686		$28,245		$30,789		30,035

See footnotes at end of table

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
MICHIGAN								
Cement:								
Portland—thousand 376-pound barrels	23,026	$77,324	22,361	$77,694	21,948	$75,172	22,682	$73,267
Masonry—thousand 280-pound barrels					1,515	4,467	1,517	4,335
Clays—thousand short tons	1,771	1,937	1,738	1,904	1,817	1,975	1,751	1,917
Copper (recoverable content of ores, etc.)—short tons	55,300	33,954	56,385	36,199	70,245	42,147	74,099	45,645
Gypsum—thousand short tons	1,721	6,595	1,463	5,609	1,295	5,095	1,278	4,791
Iron ore (usable)—thousand long tons, gross weight	7,247	62,921	10,792	95,791	9,384	87,604	9,422	85,597
Lime—thousand short tons	862	11,748	1,177	15,730	[3] 1,190	[3] 15,665	1,153	15,371
Manganiferous ore (5 to 35 percent Mn)—short tons, gross weight			180,460	(4)	17,083	(4)		
Natural gas—million cubic feet	18,916	4,350	20,790	4,449	27,697	5,844	28,987	6,174
Peat—short tons	191,661	2,357	214,402	2,755	[3] 210,376	[3] 2,009	257,533	2,277
Petroleum (crude)—thousand 42-gallon barrels	10,439	30,691	15,899	46,266	18,901	55,191	[3] 17,117	[3] 48,783
Salt—thousand short tons	4,485	35,725	4,088	33,759	3,885	31,284	4,274	33,343
Sand and gravel—do	48,052	41,193	46,910	39,304	54,603	47,790	47,563	42,029
Silver (recoverable content of ores, etc.)—thousand troy ounces							401	436
Stone—thousand short tons	30,095	30,379	31,256	32,274	28,731	30,103	28,440	29,055
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, gem stones, iodine (1961-62), magnesium compounds, natural gas liquids, potassium salts, and values indicated by footnote 4		49,371		45,864		[3] 46,306		53,500
Total		[3] 388,545		[3] 437,598		[3] 450,652		446,520
MINNESOTA								
Clays—thousand short tons	153	$267	[3] 125	[3] $163	[3] 176	[3] $241	203	$291
Iron ore (usable)—thousand long tons, gross weight	36,109	306,920	54,723	470,874	44,699	407,152	44,295	385,997
Manganiferous ore (5 to 35 percent Mn)—short tons, gross weight	429,102	(4)	441,028	(4)	181,835	(4)	292,779	(4)
Peat—short tons			1,465	72	11,091	181	12,934	307
Sand and gravel—thousand short tons	28,486	20,726	30,302	24,611	30,690	24,143	29,399	22,656
Stone—do	3,639	9,461	4,234	10,034	3,957	9,975	3,803	10,360
Value of items that cannot be disclosed: Abrasive stones, cement, fire clay (1960-61), gem stones, lime, and values indicated by footnote 4		9,993		9,767		[3] 9,222		9,325
Total		[3] 347,367		[3] 515,521		[3] 450,914		428,936

MISSISSIPPI

Clays	thousand short tons	747	$4,064	1,017	$4,786	1,104	$5,034	1,129	$5,742
Natural gas	million cubic feet	162,095	25,125	172,478	32,426	172,543	32,093	170,271	32,351
Natural gas liquids:									
Natural gasoline and cycle products	thousand gallons	23,207	1,495	23,648	1,552	25,135	1,625	25,891	1,616
LP gases	do	8,141	465	10,151	564	15,510	700	20,401	732
Petroleum (crude)	thousand 42-gallon barrels	49,620	140,921	51,673	146,235	54,688	154,220	[6] 54,471	[6] 151,429
Sand and gravel	thousand short tons	7,520	7,743	6,181	5,568	5,920	5,903	7,001	7,262
Stone	do	[7] 126	[7] 114	807	808	913	1,044	1,199	1,266
Value of items that cannot be disclosed: Certain metals and nonmetals			6,751		7,271		[6] 7,961		9,030
Total			[6] 186,678		[6] 199,210		[6] 208,580		209,428

MISSOURI

Barite	short tons	296,093	$3,924	180,702	$2,588	227,323	$3,052	303,945	$3,994
Cement:									
Portland	thousand 376-pound barrels	13,947	46,974	12,183	42,330	11,839	41,142	12,739	44,004
Masonry	thousand 280-pound barrels					437	1,398	455	1,457
Clays	thousand short tons	2,635	6,898	2,540	7,207	2,132	5,040	2,053	5,033
Coal (bituminous)	do	2,748	11,937	2,890	12,450	2,938	12,567	2,896	12,057
Copper (recoverable content of ores, etc.)	short tons	1,065	654	1,087	698	1,479	887	2,752	1,695
Iron ore (usable)	thousand long tons, gross weight	349	3,278	365	3,760	341	3,633	346	3,188
Lead (recoverable content of ores, etc.)	short tons	105,165	24,188	111,948	26,196	98,785	20,350	60,982	11,221
Lime	thousand short tons	1,324	15,714	1,254	14,701	1,173	13,873	1,176	13,703
Natural gas	million cubic feet			75	19	90	22	92	23
Petroleum (crude)	thousand 42-gallon barrels	75	[4]	75	[4]	72	[4]	[6] 55	[4]
Sand and gravel	thousand short tons	10,279	11,406	10,207	11,601	9,371	10,688	10,304	11,572
Silver (recoverable content of ores, etc.)	thousand troy ounces	340	308	16	14	12	11	491	533
Stone	thousand short tons	26,939	36,435	27,180	37,878	25,631	36,577	28,876	44,006
Zinc (recoverable content of ores, etc.)	short tons	92	21	2,821	728	5,847	1,345	2,792	642
Value of items that cannot be disclosed: Native asphalt, cobalt (1959–61), gem stones, nickel (1959–61), and values indicated by footnote 4			2,288		2,074		[6] 703		179
Total			[6] 164,025		[6] 162,244		[6] 151,288		153,307

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
MONTANA								
Chromite—short tons, gross weight	[14] 105,000	[14] $3,765	[14] 107,000	[14] $3,813	[14] 82,000	[14] $2,939		
Clays [3]—thousand short tons	46	48	63	77	55	76	56	$77
Coal (bituminous and lignite)—do	345	1,478	313	1,188	371	1,207	382	1,140
Copper (recoverable content of ores, etc.)—short tons	65,911	40,469	91,972	59,046	104,000	62,400	94,021	57,917
Fluorspar—do	18,542	(4)	31,273	(4)	14,905	(4)	(4)	(4)
Gold (recoverable content of ores, etc.)—troy ounces	28,551	999	45,922	1,607	35,377	1,238	24,387	854
Iron ore (usable)—thousand long tons, gross weight	50	254	55	293	34	209	9	62
Lead (recoverable content of ores, etc.)—short tons	7,672	1,765	4,879	1,142	2,643	544	6,121	1,126
Lime—thousand short tons	(4)	(4)	(4)	(4)	118	986	104	1,049
Manganese ore (35 percent or more Mn)—short tons, gross weight	21,604	1,520	29,036	1,996	17,515	[8] 1,372	24,758	(4)
Manganiferous ore (5 to 35 percent Mn)—do	2,415	34	676	11	2,236	33	2,264	29
Natural gas—million cubic feet	30,743	2,306	33,418	2,373	33,901	2,509	29,955	2,217
Peat—short tons					7,385	112	(4)	(4)
Petroleum (crude)—thousand 42-gallon barrels	29,857	76,434	30,240	72,878	30,906	74,793	[8] 31,648	[8] 76,690
Sand and gravel—thousand short tons	10,930	12,587	12,589	11,657	14,702	13,506	18,473	17,642
Silver (recoverable content of ores, etc.)—thousand troy ounces	3,420	3,096	3,607	3,265	3,490	3,227	4,561	4,948
Stone—thousand short tons	1,186	1,691	1,183	1,576	1,512	1,849	996	1,708
Uranium ore—short tons	2,890	(4)	1,726	29	729	10	(4)	(4)
Zinc (recoverable content of ores, etc.)—do	27,848	6,405	12,551	3,238	10,262	2,360	37,678	8,666
Value of items that cannot be disclosed: Barite, cement, chromite,[14] clays (bentonite 1959, fire clay), gem stones, gypsum, sheet mica, natural gas liquids, pyrites (1959), phosphate rock, rare-earth metal concentrates (1959, 1962), talc, tungsten (1960–62), vermiculite, and values indicated by footnote 4		15,248		15,217		[8] 14,863		16,531
Total		[8] 168,099		[8] 179,406		[8] 184,233		190,656

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NEBRASKA

Clays	thousand short tons	131	$133	108	$109	146	$148	142	$142
Gem stones		(10)	3	(10)	4	(10)	5	(10)	5
Natural gas	million cubic feet	13,128	2,087	15,258	2,670	15,743	2,629	14,880	2,708
Natural gas liquids:									
Natural gasoline	thousand gallons	(4)	(4)	(4)	(4)	(4)	(4)	12,239	809
LP gases	do	(4)	(4)	(4)	(4)	(4)	(4)	28,718	1,329
Petroleum (crude)	thousand 42-gallon barrels	22,881	65,897	23,825	68,378	24,369	69,452	9 24,850	9 70,326
Sand and gravel	thousand short tons	11,202	8,301	10,876	8,746	10,094	8,250	12,853	9,797
Stone	do	3,236	5,235	3,336	5,651	3,622	6,324	3,670	6,626
Value of items that cannot be disclosed: Cement, lime (1961-62), pumice, and values indicated by footnote 4			17,679		18,384		18,637		16,507
Total			9 99,335		9 103,942		9 105,445		108,249

NEVADA

Antimony ore and concentrate	short tons, antimony content	10	$2					
Barite	short tons	91,298	623	86,061	$591	129,524	$863	137,727	$954
Copper (recoverable content of ores, etc.)	do	57,375	35,228	77,485	49,745	78,022	46,813	82,602	50,883
Fluorspar	do	16,743	407	18,505	388	18,129	357	(4)	(4)
Gem stones		(10)	100	(10)	100	(10)	100	(10)	100
Gold (recoverable content of ores, etc.)	troy ounces	113,443	3,971	58,187	2,037	54,165	1,896	62,863	2,200
Gypsum	thousand short tons	818	2,738	802	2,721	729	2,625	817	2,952
Iron ore (usable)	thousand long tons, gross weight	698	3,712	740	3,688	845	4,608	617	3,238
Lead (recoverable content of ores, etc.)	short tons	1,357	312	987	231	1,791	369	771	142
Manganese ore (35 percent or more Mn)	short tons, gross weight	56,611	3,918	49,076	3,301	28,573	1,852		
Manganiferous ore (5 to 35 percent Mn)	do	200	(4)	(4)	(4)				
Mercury	76-pound flasks	7,156	1,628	7,821	1,648	7,486	1,480	6,573	1,257
Perlite	short tons	(4)	(4)	35,214	286	29,544	240	25,067	205
Petroleum (crude)	thousand 42-gallon barrels	32	(4)	27	(4)	154	(4)	137	(4)
Sand and gravel	thousand short tons	6,436	7,522	4,085	5,224	7,095	7,443	7,850	9,655
Silver (recoverable content of ores, etc.)	thousand troy ounces	611	553	707	640	388	359	245	266
Stone	thousand short tons	840	1,587	579	1,350	677	1,576	722	1,220
Talc and soapstone	short tons	5,824	50	4,882	30	3,090	33	6,157	55
Tungsten ore and concentrate	short tons, 60-percent WO_3 basis	(4)	(4)	(4)	(4)	(4)	(4)	156	234
Zinc (recoverable content of ores, etc.)	short tons	217	50	420	108	453	104	281	65
Value of items that cannot be disclosed: Brucite (1959), clays, diatomite, lime, magnesite, molybdenum, pumice, salt, sulfur ore, uranium ore (1959-61), and values indicated by footnote 4			8,458		8,809		9 10,815		10,307
Total			9 70,859		9 80,892		9 81,533		83,733

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
NEW HAMPSHIRE								
Beryllium concentrate—short tons, gross weight	20	$12	14	$8	23	$14	7	$4
Clays—thousand short tons	26	26	27	27	30	30	37	37
Feldspar—long tons	(4)	(4)	(4)	(4)	10,290	62	(4)	(4)
Gem stones	(10)	10	(10)	15	(10)	(4)	(10)	(4)
Mica:								
Sheet—pounds	119,163	1,133	[8] 80,077	[8] 1,026	[8] 105,943	[8] 1,009	35,450	374
Scrap—short tons	(4)	(4)	415	14	669	20	411	11
Peat—do	25	(4)	23	(4)	15	(4)		
Sand and gravel—thousand short tons	5,124	2,887	6,621	3,687	7,701	3,627	8,260	4,119
Stone—do	82	488	104	594	117	684	154	1,368
Value of items that cannot be disclosed: Values indicated by footnote 4		166		68		20		97
Total		4,722		[8] 5,439		[8] 5,466		6,010
NEW JERSEY								
Clays—thousand short tons	700	$1,895	664	$1,597	657	$1,681	584	$1,476
Gem stones	(10)	6	(10)	7	(10)	9	(10)	9
Peat—short tons	28,300	278	25,100	192	21,257	212	26,066	247
Sand and gravel—thousand short tons	11,033	18,620	11,594	19,511	12,257	20,895	13,728	21,230
Stone—do	10,079	22,133	10,202	22,814	11,315	24,539	14,214	28,979
Zinc (recoverable content of ores, etc.) [15]—short tons					112	26	15,309	3,559
Value of items that cannot be disclosed: Iron ore, lime, magnesium compounds, manganiferous residuum, greensand marl, titanium concentrate (ilmenite 1962) and uranium ore (1960)		[8] 16,612		[8] 12,348		[8] 11,908		10,186
Total		[8] 59,544		[8] 56,469		[8] 59,270		65,686

Barite—short tons	320	$6	492	$10	600	$10	252	$4
Beryllium concentrate—short tons, gross weight	11	6			24	12	34	19
Carbon dioxide, natural—thousand cubic feet	(4)	(4)	230,115	(4)	242,903	24	826,810	74
Clays—thousand short tons	[3] 45	[3] 77	[3] 56	[3] 132	[3] 67	[3] 165	52	156
Coal (bituminous)—do	149	837	295	1,747	412	2,477	677	2,595
Copper (recoverable content of ores, etc.)—short tons	39,688	24,369	67,288	43,199	79,606	47,764	82,683	50,933
Fluorspar—do	200	7						
Gem stones	(10)	39	(10)	40	(10)	46	(10)	45
Gold (recoverable content of ores, etc.)—troy ounces	3,155	110	5,423	190	6,201	217	7,529	264
Gypsum—thousand short tons			55	193	105	386	151	564
Helium—thousand cubic feet	16,903	264	43,494	684	42,224	762	27,377	958
Iron ore (usable)—thousand long tons, gross weight	(10)	(4)	1	27	(10)	(4)	9	121
Lead (recoverable content of ores, etc.)—short tons	829	191	1,996	467	2,332	480	1,134	209
Lime—thousand short tons	16	209	36	496	25	350	29	403
Manganese ore (35 percent or more Mn)—short tons, gross weight	27,528	2,248					(4)	(4)
Mica:								
Scrap—short tons	210	7	235	7	1,800	52	5,731	140
Sheet—pounds	247	2	(4)	(4)			(4)	(4)
Natural gas—million cubic feet	739,660	73,966	798,928	85,485	789,662	86,073	804,612	92,530
Natural gas liquids:								
Natural gasoline and cycle products—thousand gallons	264,133	16,859	321,667	20,412	301,404	18,619	273,969	16,775
LP gases—do	552,257	22,320	645,116	28,788	656,751	24,154	661,330	20,359
Perlite—short tons	240,642	2,121	240,593	2,119	245,654	2,159	258,164	2,143
Petroleum (crude)—thousand 42-gallon barrels	105,692	301,394	107,380	305,895	112,553	322,142	[6] 108,708	[6] 313,133
Potassium salts—thousand short tons, K_2O equivalent	2,189	74,117	2,440	82,645	2,523	96,380	2,208	85,124
Pumice—thousand short tons	493	1,023	365	827	339	879	308	741
Salt—do	36	322	39	331	33	284	43	334
Sand and gravel—do	12,460	13,332	7,419	7,459	12,523	10,049	6,889	8,021
Silver (recoverable content of ores, etc.)—thousand troy ounces	159	144	304	275	283	261	302	327
Stone—thousand short tons	461	542	1,277	1,692	1,853	2,206	2,004	2,782
Uranium ore—short tons	3,269,826	53,463	3,793,494	61,827	3,631,036	62,482	3,478,238	63,504
Zinc (recoverable content of ores, etc.)—do	4,636	1,066	13,770	3,553	22,900	5,267	22,015	5,063
Value of items that cannot be disclosed: Cement (1960–62), fire clay (1959–61), molybdenum, magnesium compounds (1959–61), manganiferous ore, vanadium, and values indicated by footnote 4		3,771		5,266		[8] 7,213		6,743
Total		[8] 592,812		[8] 653,766		[8] 690,913		674,064

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
NEW YORK								
Clays—thousand short tons	1,309	$1,714	1,172	$1,717	1,037	$1,373	1,397	$1,618
Emery—short tons	8,555	150	8,169	142	6,180	106	4,316	71
Gem stones	(10)	8	(10)	9	(10)	10	(10)	10
Gypsum—thousand short tons	919	4,663	755	3,928	663	3,441	601	3,122
Iron ore (usable)—thousand long tons, gross weight	2,044	28,050	2,484	32,977	1,973	25,548	2,099	24,953
Lead (recoverable content of ores, etc.)—short tons	481	111	775	181	879	181	1,063	196
Natural gas—million cubic feet	2,915	889	4,990	1,542	5,742	1,694	4,262	1,198
Peat—short tons	12,875	138	10,042	146	11,209	123	16,200	113
Petroleum (crude)—thousand 42-gallon barrels	1,970	8,353	1,813	8,412	1,658	7,892	[6] 1,789	[6] 8,229
Salt—thousand short tons	4,011	30,958	4,008	30,763	4,149	30,761	4,456	32,236
Sand and gravel—do	27,943	31,415	30,687	35,152	28,043	30,471	29,447	31,346
Silver (recoverable content of ores, etc.)—thousand troy ounces	52	47	49	45	41	37	19	21
Stone—thousand short tons	28,640	46,556	29,802	46,955	26,951	43,734	27,589	47,256
Zinc (recoverable content of ores, etc.)—short tons	43,464	9,997	66,364	17,122	54,763	12,595	53,654	12,340
Value of items that cannot be disclosed: Beryllium concentrate (1960-61), cement, abrasive garnet, lime, talc, titanium concentrate, and wollastonite	----------	76,904	----------	81,831	----------	[8] 75,867	----------	79,183
Total	----------	[8] 239,953	----------	[8] 260,922	----------	[8] 233,833	----------	241,892

NORTH CAROLINA

Abrasive stones	short tons	[17] 191	[17] $5	([10])	[18] $2	([10])	[18] $3	([10])	[18] $2
Clays [9]	thousand short tons	2,524	1,522	2,476	1,548	2,603	1,669	2,731	1,782
Feldspar	long tons	([4])	([4])	270,761	2,781	251,858	2,477	244,708	2,373
Gem stones		([10])	9	([10])	4	([10])	6	([10])	2
Gold (recoverable content of ores, etc.)	troy ounces	965	34	1,826	64	2,094	73	460	16
Iron ore (usable)	thousand long tons	([4])	([4])	([4])	([4])	([4])	1	1	13
Lead (recoverable content of ores, etc.)	short tons			424	99	318	66	219	40
Mica:									
Scrap	do	47,736	1,212	47,281	1,100	53,615	1,010	61,983	1,384
Sheet	pounds	505,623	1,755	[8] 436,579	1,539	390,870	2,237	320,305	867
Sand and gravel	thousand short tons	8,580	7,426	8,801	7,453	9,779	8,467	12,516	11,457
Silver (recoverable content of ores, etc.)	thousand troy ounces	16	15	212	192	170	157	100	109
Stone	thousand short tons	12,859	20,302	14,721	23,296	15,921	25,262	19,308	29,533
Talc and pyrophyllite	short tons	127,296	647	100,593	549	90,711	367	100,298	433
Value of items that cannot be disclosed: Abrasive stone (millstones 1959), asbestos, barite (1961), clay (kaolin), copper, lithium minerals, olivine, tungsten concentrate, and values indicated by footnote 4			7,862		6,469		8,329		6,586
Total			40,789		45,096		50,124		54,597

NORTH DAKOTA

Clays	thousand short tons	[3] 61	[3] $79	[3] 102	[3] $129	([4])	([4])	98	$124
Coal (lignite)	do	2,413	5,426	2,525	5,790	2,726	$6,141	2,733	6,135
Gem stones		([10])	1	([10])	1	([10])	1	([10])	1
Natural gas	million cubic feet	17,915	1,774	19,483	2,221	20,100	2,533	25,155	3,446
Natural gas liquids:									
Natural gasoline	thousand gallons	([4])	([4])	([4])	([4])	([4])	([4])	16,872	1,085
LP gases	do	([4])	([4])	([4])	([4])	([4])	([4])	68,881	2,665
Petroleum (crude)	thousand 42-gallon barrels	17,824	49,907	21,992	59,598	23,652	64,333	[6] 25,164	[6] 69,201
Sand and gravel	thousand short tons	9,883	6,516	8,648	6,904	9,395	7,507	9,615	7,122
Stone	do	48	84	28	44	40	40	19	19
Value of items that cannot be disclosed: Clays (bentonite 1959–60, fire clay 1960), salt (1960–62), uranium ore (1962), and values indicated by footnote 4			3,555		3,691		4,370		774
Total			67,342		78,378		[8] 84,925		90,572

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
OHIO								
Abrasive stones, grindstones and pulpstones—short tons	1,081	$101	(4)	(4)	(4)	(4)	(4)	(4)
Cement:								
Portland—thousand 376-pound barrels	18,994	63,935	17,480	$61,478	15,308	$53,251	15,353	$51,006
Masonry—thousand 280-pound barrels					846	2,604	946	2,793
Clays—thousand short tons	5,478	15,346	5,165	14,325	4,923	13,790	4,751	12,979
Coal (bituminous)—do	35,112	135,729	33,957	130,877	32,226	121,343	34,125	127,051
Gem stones	(10)	2	(10)	3	(10)	4	(10)	3
Lime—thousand short tons	3,190	45,121	3,117	44,403	[8] 3,048	[8] 41,266	3,102	43,792
Natural gas—million cubic feet	34,664	8,042	36,074	8,477	36,423	9,069	36,747	9,407
Peat—short tons	5,813	73	6,755	93	9,113	123	7,783	106
Petroleum (crude)—thousand 42-gallon barrels	5,978	17,157	5,405	16,053	5,639	17,425	[8] 5,066	[8] 15,705
Salt—thousand short tons	2,858	20,486	3,108	24,149	3,465	25,037	4,187	28,706
Sand and gravel—do	38,604	45,139	37,943	44,979	33,688	41,272	35,204	43,333
Stone—do	[7] 36,155	[7] 59,326	[7] 35,856	[7] 59,479	33,652	55,701	34,470	57,202
Value of items that cannot be disclosed: Gypsum, stone (dimension limestone 1960, calcareous marl 1959–60), and values indicated by footnote 4		2,027		1,826		1,566		1,588
Total		[8] 412,484		[8] 406,142		[8] 382,451		393,671

OKLAHOMA

Clays[3] thousand short tons	966	$970	734	$739	792	$801	737	$756
Coal (bituminous) do	1,525	10,272	1,342	9,113	1,032	6,784	1,048	6,978
Gypsum do	(4)	(4)	(4)	(4)	(4)	(4)	509	1,668
Helium thousand cubic feet	98,749	1,619	289,068	4,691	313,244	5,872	284,214	9,917
Lead (recoverable content of ores, etc.) short tons	601	138	936	219	980	202	2,710	499
Natural gas million cubic feet	811,508	81,151	824,266	98,088	892,697	108,016	1,060,717	135,772
Natural gas liquids:								
Natural gasoline and cycle products thousand gallons	448,353	29,443	531,995	33,074	521,237	33,358	552,795	35,764
LP gases do	675,869	27,070	762,258	32,409	817,082	30,141	838,903	25,223
Petroleum (crude) thousand 42-gallon barrels	198,090	578,423	192,913	563,306	193,081	561,866	[6] 198,616	[6] 579,959
Salt thousand short tons	(4)	(4)	3	16	3	19	5	25
Sand and gravel do	6,002	5,927	6,424	7,468	5,310	5,513	4,436	4,736
Stone do	12,683	14,980	[7] 14,054	[7] 16,098	14,981	16,561	14,666	18,819
Zinc (recoverable content of ores, etc.) short tons	1,049	241	2,332	602	3,148	724	10,013	2,303
Value of items that cnnot be disclosed: Native asphalt (1959–60), clay (bentonite), cement, gem stones, lime, pumice, stone (crushed granite 1960), tripoli, and values indicated by footnote 4		18,156		16,756		21,920		20,853
Total		[8] 768,390		[8] 782,579		[8] 791,777		843,272

OREGON

Clays thousand short tons	294	$308	318	$370	294	$357	249	$305
Copper (recoverable content of ores, etc.) short tons			6	4	(4)	(4)	(4)	(4)
Gold (recoverable content of ores, etc.) troy ounces	686	24	835	29	1,054	37	822	29
Lime thousand short tons			(4)	(4)	[8] 82	[8] 1,702	78	1,514
Mercury 76-pound flasks	1,224	278	513	108	138	27	(4)	(4)
Nickel (content of ore and concentrate) short tons	12,374	(4)	13,115	5,246	12,860	(4)	13,110	(4)
Perlite do							3	(5)
Pumice thousand short tons	(4)	(4)	(4)	(4)	203	461	(4)	(4)
Sand and gravel do	18,087	15,506	17,673	16,170	12,299	13,680	14,869	14,556
Silver (recoverable content of ores, etc.) thousand troy ounces	(10)	(5)	(10)	(5)	2	2	6	7
Stone thousand short tons	13,341	16,126	16,913	19,721	[8] 17,455	[8] 21,202	18,258	20,977
Uranium ore short tons			(4)	(4)	2,160	66	2,722	112
Zinc (recoverable content of ores, etc.) do					3	1		
Value of items that cannot be disclosed: Asbestos (1959–61), carbon dioxide (1959–60), cement, diatomite, gem stones, iron ore (pigment material 1959, 1961), lead (1961), and values indicated by footnote 4		18,607		14,124		15,557		14,956
Total		[8] 50,849		[8] 55,772		[8] 53,092		52,458

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
PENNSYLVANIA								
Cement:								
Portland—thousand 376-pound barrels	43,356	$150,918	38,320	$131,763	36,635	$124,506	38,463	$127,969
Masonry—thousand 280-pound barrels					2,678	7,232	2,565	7,105
Clays—thousand short tons	3,466	17,196	[3] 3,557	[3] 16,536	[3] 2,999	[3] 14,402	[3] 2,893	[3] 12,815
Coal:								
Anthracite—do	20,649	172,320	18,817	147,116	17,446	140,338	16,894	134,094
Bituminous—do	65,347	345,332	65,425	345,971	62,652	323,758	65,315	331,298
Cobalt (content of concentrate)—thousand pounds	280	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Gem stones	(10)	3	(10)	1	(10)	5	(10)	4
Lime—thousand short tons	1,263	18,261	1,120	16,277	[3] 1,093	[3] 16,428	1,104	16,647
Natural gas—million cubic feet	99,366	29,015	113,928	36,229	100,427	29,526	90,053	24,494
Natural gas liquids:								
Natural gasoline—thousand gallons	2,884	184	1,399	85	1,272	74	1,350	75
LP gases—do	1,484	36	1,580	138	1,453	115	1,521	112
Peat—short tons	26,948	262	30,837	325	27,993	291	32,936	369
Petroleum (crude)—thousand 42-gallon barrels	6,160	25,872	6,009	27,341	5,643	26,579	[6] 5,225	[6] 23,878
Sand and gravel—thousand short tons	14,257	23,233	13,011	21,204	12,594	19,766	14,419	23,587
Stone—do	43,682	77,421	42,136	74,168	41,834	71,344	48,144	82,087
Zinc (recoverable content of ores, etc.)[16]—short tons	16,718	3,828	13,746	3,559	23,428	5,408	24,308	5,652
Value of items that cannot be disclosed: Clays (kaolin 1960–62), copper, gold, graphite (1959–61), iron ore, scrap mica, pyrites, pyrophyllite and soapstone, silver, tripoli, and values indicated by footnote 4		15,812		17,430		25,355		32,966
Total		[8] 879,693		[8] 838,146		[8] 805,127		823,152
RHODE ISLAND								
Sand and gravel—thousand short tons	1,740	$1,588	1,535	$1,355	1,726	$1,666	2,346	$1,890
Stone—do	(4)	(4)	1,810	4,372	(4)	(4)	[7] 304	[7] 483
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 4		745				1,413		621
Total		2,333		5,727		3,079		2,994

SOUTH CAROLINA

Clays	thousand short tons	1,160	$5,920	1,297	$6,201	1,346	$6,169	1,518	$7,165
Mica (sheet)	pounds	251	3	101	1	12	(3)		
Peat	short tons	4,194	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Sand and gravel	thousand short tons	3,104	3,077	3,029	3,048	2,904	3,067	3,318	3,670
Stone	do	[7] 6,248	[7] 8,647	7,327	10,593	6,752	9,827	6,382	10,066
Value of items that cannot be disclosed: Barite, cement, feldspar, gem stones (1962), kyanite, scrap mica, pyrites (1960–62), stone (crushed limestone 1959, crushed sandstone 1959, calcareous marl 1959), vermiculite, and values indicated by footnote 4			13,640		11,144		12,311		13,000
Total			[8] 31,287		[8] 30,987		[8] 31,374		33,901

SOUTH DAKOTA

Beryllium concentrate	short tons, gross weight	156	$84	167	$88	238	$130	144	$77
Cement:									
Portland	thousand 376-pound barrels	(4)	(4)	(4)	(4)	(4)	(4)	2,316	7,369
Masonry	thousand 280-pound barrels	(4)	(4)	(4)	(4)	(4)	(4)	60	197
Clays	thousand short tons	[3] 227	[3] 227	[3] 202	[3] 202	[3] 249	[3] 249	249	690
Coal (lignite)	do	22	88	20	83	18	75	18	77
Copper (recoverable content of ores, etc.)	short tons			1	1				
Feldspar	long tons	30,825	196	45,588	292	29,354	186	29,697	191
Gem stones		(10)	20	(10)	20	(10)	18	(10)	20
Gold (recoverable content of ores, etc.)	troy ounces	577,730	20,221	554,771	19,417	557,855	19,525	577,232	20,203
Gypsum	thousand short tons	19	78	22	89	22	89	23	93
Iron ore (usable)	thousand long tons			(4)	(4)	22	100	34	113
Lead (recoverable content of ores, etc.)	short tons							3	1
Mica:									
Scrap	short tons	158	5	205	10	1,054	32	210	6
Sheet	pounds	38,775	158	30,887	145	18,086	37	2,085	12
Petroleum (crude)	thousand 42-gallon barrels	151	(4)	281	(4)	233	(4)	[6] 170	(4)
Sand and gravel	thousand short tons	17,775	11,058	13,548	9,359	11,324	7,336	15,371	9,207
Silver (recoverable content of ores, etc.)	thousand troy ounces	124	113	108	98	127	118	113	123
Stone	thousand short tons	2,721	7,243	3,149	7,909	2,806	6,642	2,852	6,533
Uranium ore	short tons	45,734	606	41,104	586	43,588	495	29,452	370
Value of items that cannot be disclosed: Clays (bentonite), lime, lithium minerals (1959–60, 1962), vanadium (1960–62), and values indicated by footnote 4			9,401		9,376		[8] 8,975		507
Total			[8] 49,498		[8] 47,675		[8] 44,007		45,789

See footnotes at end of table

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
TENNESSEE								
Barite—short tons	(4)	(4)	(4)	(4)	(4)	(4)	13,797	$229
Cement:								
Portland—thousand 376-pound barrels	9,153	$28,934	8,246	$27,384	8,357	$26,964	8,509	27,741
Masonry—thousand 280-pound barrels					1,018	2,753	1,089	2,931
Clays—thousand short tons	1,146	4,952	1,270	4,537	[3] 1,040	[3] 4,190	[3] 1,037	[3] 4,597
Coal (bituminous)—do	5,913	23,581	5,930	21,154	5,860	20,681	6,214	22,555
Copper (recoverable content of ores, etc.)—short tons	11,490	7,055	12,723	8,168	12,272	7,363	14,298	8,808
Gem stones	(10)	(5)	(10)	1	(10)	1	(10)	1
Gold (recoverable content of ores, etc.)—troy ounces	99	3	123	4	152	5	158	6
Iron ore (usable)—thousand long tons, gross weight	21	111	(4)	(4)	(4)	(4)	(4)	(4)
Lead (recoverable content of ores, etc.)—short tons							51	9
Manganese ore (35 percent or more Mn)—short tons, gross weight	7,586	589	283	15				
Manganiferous ore (5 to 35 percent Mn)—do	56	1	(4)	(4)				
Natural gas—million cubic feet	52	9	63	11	71	13	75	14
Petroleum (crude)—thousand 42-gallon barrels	6	(4)	20	(4)	17	(4)	[6] 18	(4)
Phosphate rock—thousand long tons	1,755	13,255	1,939	15,424	2,235	18,675	2,418	19,868
Sand and gravel—thousand short tons	6,221	7,570	6,293	7,655	6,232	8,046	6,075	8,018
Silver (recoverable content of ores, etc.)—thousand troy ounces	60	54	65	58	83	77	112	122
Stone—thousand short tons	18,767	29,094	20,074	29,942	23,940	35,906	24,398	35,614
Zinc (recoverable content of ores, etc.)—short tons	89,932	20,684	91,394	23,579	81,734	18,799	71,548	16,456
Value of items that cannot be disclosed: Clay (fuller's earth 1961–62), lime, scrap mica (1959–60), pyrites, and values indicated by footnote 4		7,392		7,606		[6] 7,238		7,061
Total		[6] 143,284		[6] 145,538		[6] 150,711		154,030

Cement:									
Portland	thousand 376-pound barrels	27,991	$88,067	23,365	$76,577	25,101	$80,808	26,204	$83,162
Masonry	thousand 280-pound barrels					851	2,529	926	2,774
Clays [8]	thousand short tons	3,870	5,703	3,302	5,058	3,786	5,737	3,744	5,634
Gem stones		(10)	100	(10)	100	(10)	150	(10)	150
Gypsum	thousand short tons	1,351	4,770	1,131	3,960	1,074	[9] 3,832	1,120	3,956
Helium	thousand cubic feet	238,113	3,918	120,921	2,044	173,066	3,196	245,623	8,552
Lime	thousand short tons	809	8,530	821	9,087	[9] 790	[9] 8,703	1,047	11,999
Natural gas	million cubic feet	5,718,993	617,651	5,892,704	665,876	5,963,605	733,523	6,080,210	747,866
Natural gas liquids:									
Natural gasoline and cycle products	thousand gallons	2,790,155	209,238	2,880,906	207,583	3,111,427	214,279	3,205,517	233,345
LP gases	do	4,353,368	181,148	4,476,142	200,478	4,768,222	185,558	5,012,291	189,382
Petroleum (crude)	thousand 42-gallon barrels	971,978	2,893,146	927,479	2,748,735	939,191	2,791,377	[6] 936,508	[6] 2,796,136
Salt	thousand short tons	4,519	17,498	4,756	18,222	4,695	17,682	5,553	19,485
Sand and gravel	do	35,295	34,726	29,844	30,754	27,398	30,691	30,076	33,097
Stone	do	42,172	47,787	39,029	45,088	38,316	45,874	38,067	48,988
Sulfur (Frasch process)	thousand long tons	2,970	68,998	2,747	62,855	2,730	62,720	2,555	57,297
Talc and soapstone	short tons	60,945	283	67,031	336	78,214	376	73,635	387
Value of items that cannot be disclosed: Abrasive stones (1959), native asphalt, barite (1961–62), bromine, clay (fuller's earth), coal (lignite), feldspar (1959–61), graphite, iron ore, magnesium chloride (for metal), magnesium compounds (except for metal), mercury (1959–60), pumice (1961–62), sodium sulfate, and uranium ore			48,544		49,666		50,923		58,774
Total			[6] 4,230,107		[6] 4,126,419		[6] 4,237,958		4,300,984

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
UTAH								
Asphalt and related bitumens, native: Gilsonite—short tons	379,362	$9,385	383,037	$10,020	(4)	(4)	(4)	(4)
Carbon dioxide, natural—thousand cubic feet	69,625	5	60,425	4	78,136	$5	81,920	$6
Clays—thousand short tons	[3] 185	[3] 484	[3] 143	[3] 416	143	1,080	174	1,403
Coal (bituminous)—do	4,545	27,982	4,955	31,458	5,159	31,126	4,297	23,209
Copper (recoverable content of ores, etc.)—short tons	144,715	88,855	218,049	139,987	213,534	128,120	218,018	134,299
Fluorspar—do	(4)	(4)	1,912	51	610	18	399	12
Gem stones	(10)	134	(10)	72	(10)	73	(10)	75
Gold (recoverable content of ores, etc.)—troy ounces	239,517	8,383	368,255	12,889	342,988	12,005	311,924	10,917
Iron ore (usable)—thousand long tons, gross weight	2,842	19,979	3,334	23,862	3,533	25,493	2,630	18,242
Lead (recoverable content of ores, etc.)—short tons	36,630	8,425	39,398	9,219	40,894	8,424	38,199	7,029
Lime—thousand short tons	90	1,773	127	2,672	142	2,626	163	2,759
Manganese ore (35 percent or more Mn)—short tons, gross weight	1,511	124						
Natural gas—million cubic feet	38,921	5,527	51,040	9,187	57,175	8,976	74,128	12,454
Perlite—short tons	(4)	(4)	(4)	(4)	(4)	(4)	929	3
Petroleum (crude)—thousand 42-gallon barrels	39,959	114,283	37,594	103,008	33,118	91,075	[3] 30,964	[3] 84,841
Pumice—thousand short tons	39	81	60	134	60	95	28	46
Salt—do	209	2,453	231	3,092	249	3,187	311	3,349
Sand and gravel—do	8,843	6,436	6,848	6,182	[3] 18,325	[3] 16,979	19,941	20,954
Silver (recoverable content of ores, etc.)—thousand troy ounces	3,734	3,380	4,783	4,329	4,798	4,435	4,628	5,022
Stone—thousand short tons	3,338	4,048	1,837	3,087	1,808	3,219	2,118	3,865
Uranium ore—short tons	1,210,654	37,310	1,089,757	27,843	1,098,783	25,734	781,955	23,653
Vanadium (recoverable in ore and concentrate)—do	536	(4)	462	(4)	514	(4)	525	(4)
Zinc (recoverable content of ores, etc.)—do	35,223	8,101	35,476	9,153	37,239	8,565	34,313	7,892
Value of items that cannot be disclosed: Barite, cement, clay (kaolin 1959–60), gypsum, molybdenum, natural gas liquids, phosphate rock, potassium salts, pyrites (1959–60), and values indicated by footnote 4		27,396		36,047		45,554		50,382
Total		[3] 374,544		[3] 432,712		[3] 416,789		410,412
VERMONT								
Gem stones	(10)	$1	(10)	$1	(10)	$2	(10)	$2
Sand and gravel—thousand short tons	2,320	1,590	1,809	1,218	2,232	1,567	1,430	1,076
Stone—do	944	17,372	2,114	17,444	2,731	18,715	1,715	19,815
Value of items that cannot be disclosed: Asbestos, clays, lime, and talc		4,420		4,240		4,012		4,237
Total		[3] 23,383		[3] 22,903		[3] 24,296		25,130

VIRGINIA

Aplite—long tons	(4)	(4)	(4)	(4)	97,465	$651	125,156	$912
Clays—thousand short tons	1,346	$1,396	1,348	$1,395	1,406	1,332	1,464	1,444
Coal (bituminous)—do	29,769	139,224	27,838	122,723	30,332	126,121	29,474	117,560
Gem stones	(10)	4	(10)	5	(10)	6	(10)	6
Lead (recoverable content of ores, etc.)—short tons	2,770	637	2,152	504	3,733	769	4,059	747
Lime—thousand short tons	765	8,168	711	8,028	[8] 657	[8] 7,375	615	7,668
Manganese ore (35 percent or more Mn)—short tons, gross weight	6,232	499						
Mica, sheet—pounds	108	1	103	1	(4)	(4)		
Natural gas—million cubic feet	2,280	597	2,227	604	2,466	668	2,499	677
Petroleum (crude)—thousand 42-gallon barrels	6	(4)	2	(4)	2	(4)	[6] 3	(4)
Sand and gravel—thousand short tons	8,452	12,369	7,666	11,432	9,839	14,697	9,745	16,375
Silver (recoverable content of ores, etc.)—thousand troy ounces	1	1						
Stone—thousand short tons	17,787	31,447	19,358	33,019	22,934	39,206	25,766	43,121
Zinc (recoverable content of ores, etc.) [15]—short tons	20,334	4,662	19,885	5,142	29,163	6,726	26,479	6,141
Value of items that cannot be disclosed: Cement, feldspar, gypsum, iron ore (pigment materials 1960–62), kyanite, manganiferous ore (1959), pyrites, salt, talc and soapstone, titanium concentrate, and values indicated by footnote 4		28,848		26,027		[8] 27,747		27,843
Total		[8] 227,853		[8] 208,880		[8] 225,298		222,494

WASHINGTON

Barite—short tons	(4)	(4)	(4)	(4)	5,100	$42	(4)	(4)
Clays [3]—thousand short tons	180	$171	169	$162	145	138	103	$100
Coal (bituminous)—do	242	1,841	228	1,721	191	1,381	235	1,630
Copper (recoverable content of ores, etc.)—short tons	49	30	78	50	66	40	41	25
Iron ore (usable)—thousand long tons	4	5						
Lead (recoverable content of ores, etc.)—short tons	10,310	2,371	7,725	1,808	8,053	1,659	6,033	1,110
Manganese ore (35 percent or more Mn)—short tons, gross weight	83	(4)						
Peat—short tons	32,884	124	27,770	121	[8] 57,393	[8] 363	42,762	288
Petroleum (crude)—thousand 42-gallon barrels	1	(4)	1	(4)	(20)	(1)		
Pumice—thousand short tons	9	112	(4)	(4)	(4)	(4)	10	130
Sand and gravel—do	21,360	18,576	25,594	19,459	18,994	16,145	19,580	18,145
Stone—do	12,278	13,587	13,897	15,796	11,464	14,758	12,749	18,180
Talc and soapstone—short tons	4,073	23	2,406	12	2,927	23	2,835	11
Uranium ore—do	152,336	(4)	171,255	3,223	175,327	3,582	110,948	2,050
Zinc (recoverable content of ores, etc.)—do	17,111	3,936	21,317	5,500	20,217	4,650	21,644	4,978
Value of items that cannot be disclosed: Abrasive stone (grinding pebbles), carbon dioxide, cement, clays (fire clay, bentonite 1961), diatomite, epsom salts (1961–62), gem stones, gold, gypsum, magnesite, olivine, silver, strontium minerals (1959), tungsten (1961), and values indicated by footnote 4		25,054		24,552		23,667		21,827
Total		[8] 65,830		[8] 72,404		[8] 66,448		68,474

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States by States—Continued

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
WEST VIRGINIA								
Clays thousand short tons	596	$2,492	626	$2,639	475	$2,193	447	$2,086
Coal (bituminous) do	119,692	621,003	118,944	597,222	113,070	558,525	118,499	578,293
Gem stones	(10)	1	(10)	1	(10)	(4)	(10)	(4)
Natural gas million cubic feet	204,633	53,205	208,757	54,694	210,556	57,692	210,698	57,942
Natural gas liquids:								
Natural gasoline thousand gallons	29,242	1,808	23,211	1,513	34,095	2,296	32,921	2,216
LP gases do	308,316	15,534	329,874	16,527	342,646	17,826	344,969	17,475
Petroleum (crude) thousand 42-gallon barrels	2,184	7,862	2,300	9,361	2,760	11,426	[6] 3,345	[6] 13,380
Salt thousand short tons	811	3,305	920	3,673	899	3,510	1,042	4,635
Sand and gravel do	4,854	10,513	4,506	9,802	4,882	10,152	5,202	10,942
Stone do	[7] 5,923	[7] 10,482	[7] 8,001	[7] 14,001	7,628	13,244	[7] 7,506	[7] 13,242
Value of items that cannot be disclosed: Bromine (1959–60), calcium-magnesium chloride, cement, lime, stone (dimension sandstone 1959–60, 1961, calcareous marl 1959) and values indicated by footnote 4		13,318		13,195		13,385		14,753
Total		[8] 739,523		[8] 722,628		[8] 690,250		714,964
WISCONSIN								
Abrasive stones short tons	770	$27	397	$12	560	$17	569	$17
Clays thousand short tons	178	192	144	156	126	130	137	156
Iron ore (usable) thousand long tons, gross weight	701	(4)	1,502	(4)	1,122	(4)	1,045	(4)
Lead (recoverable content of ores, etc.) short tons	745	171	1,165	273	680	140	1,394	256
Peat do	7,500	(4)	8,500	(4)	(4)	(4)	(4)	(4)
Sand and gravel thousand short tons	41,999	27,535	35,681	25,648	39,978	28,457	33,649	24,408
Stone do	13,522	23,782	16,486	22,302	13,418	19,686	13,392	19,709
Zinc (recoverable content of ores, etc.) short tons	11,635	2,676	18,410	4,750	13,865	3,189	13,292	3,057
Value of items that cannot be disclosed: Cement, gem stones, lime, and values indicated by footnote 4		18,541		25,619		[8] 21,892		20,686
Total		[8] 72,924		[8] 78,760		[8] 73,511		68,289

WYOMING

Beryllium concentrate	short tons, gross weight	1	(5)	5	$2	2	$1	1	(5)
Clays	thousand short tons	[3] 764	[3] $9,449	[3] 788	[3] 9,571	[3] 859	[3] 10,301	1,141	$11,138
Coal (bituminous)	do	1,977	6,669	2,024	6,992	2,529	8,573	2,569	8,198
Copper (recoverable content of ores, etc.)	short tons					1	1		
Gem stones		(10)	76	(10)	68	(10)	83	(10)	85
Gold (recoverable content of ores, etc.)	troy ounces			40	1	1	(5)		
Gypsum	thousand short tons	9	31	13	46	(4)	(4)	(4)	(4)
Iron ore (usable)	thousand long tons, gross weight	503	2,923	(4)	(4)	(4)	(4)	739	6,441
Natural gas	million cubic feet	156,978	12,715	181,610	21,793	194,674	24,334	204,996	29,929
Natural gas liquids:									
Natural gasoline	thousand gallons	64,586	4,003	72,195	4,535	76,349	4,705	78,780	4,935
LP gases	do	90,314	3,951	120,693	5,279	132,831	5,451	149,438	5,762
Petroleum (crude)	thousand 42-gallon barrels	126,050	315,125	133,910	336,114	141,937	354,843	[6] 145,167	[6] 361,466
Pumice	thousand short tons	94	77	33	30	20	20	42	41
Sand and gravel	do	4,692	3,982	5,928	5,356	6,669	5,356	7,769	8,104
Stone	do	1,317	1,791	1,401	2,302	2,594	3,315	1,755	3,054
Uranium ore	short tons	864,582	17,610	1,357,225	27,387	1,521,064	28,218	1,301,784	25,715
Vanadium (recoverable in ore and concentrate)	do			(4)	(4)	(4)	(4)	(4)	442
Value of items that cannot be disclosed: Cement, clays (fire clay 1959, 1961, miscellaneous clay 1959–61), lime (1961–62), sheet mica (1959–61), phosphate rock, silver (1960–61), sodium carbonates and sulfates, vermiculite (1961–62), and values indicated by footnotes 4			15,970		19,780		21,046		20,467
Total			[8] 394,372		[8] 439,256		[8] 466,247		485,777

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes certain cement, included with "Value of items that cannot be disclosed."
[3] Excludes certain clays, included with "Value of items that cannot be disclosed."
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Less than $500.
[6] Preliminary figure.
[7] Excludes certain stone, included with "Value of items that cannot be disclosed."
[8] Revised figure.
[9] Less than 500 short tons.
[10] Weight not recorded.
[11] Less than 0.5 ton.
[12] Includes 805 tons of low-grade beryllium ore in 1961 and 760 tons of 3.05 percent BeO concentrate in 1962.
[13] Excludes salt in brine, included with "Value of items that cannot be disclosed."
[14] Excludes quantity consumed by American Chrome Co.
[15] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.
[16] Less than 500 long tons.
[17] Grinding pebbles and tube-mill liners.
[18] Millstones only.
[19] Less than 500 troy ounces.
[20] Less than 500 barrels.

TABLE 6.—Mineral production [1] in the Canal Zone and islands administered by the United States [2]

Area and mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
American Samoa:								
Pumice, thousand short tons							50	$108
Sand and gravel, do							3	4
Stone, do	178	$219	523	$261	362	$286	1,103	1,788
Total		219		261		286		1,900
Canal Zone:								
Sand and gravel, thousand short tons	14	21	65	68	75	73	70	77
Stone (crushed), do	223	270	203	306	163	271	207	359
Total		291		374		344		436
Canton:								
Sand and gravel, thousand short tons	(3)	(4)						
Stone (crushed), do	(3)	1					(3)	(4)
Guam:								
Sand and gravel, thousand short tons	28	20	1	1	38	49		
Stone, do	568	1,109	962	2,194	292	591	82	123
Total		1,129		2,195		640		123
Johnston:								
Sand and gravel, thousand short tons			1	4	1	1		
Stone, do			2	5	1	2		
Total				9		3		
Midway: Stone (crushed), thousand short tons					11	34		
Virgin Islands: Stone (crushed), do	14	51	15	51	20	75	21	82
Wake: Stone (crushed), do	32	34	36	49	24	62	5	41

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Production data for Canton and Wake furnished by U.S. Department of Commerce, Civil Aeronautics Administration; Midway and Johnston, by U.S Department of the Navy; Guam, by the Government of Guam; American Samoa, by the Government of American Samoa.

[3] Less than 500 short tons.

[4] Less than $500.

TABLE 7.—Mineral production [1] in the Commonwealth of Puerto Rico

Mineral	1959		1960		1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement.....thousand 376-pound barrels	5,392	$16,982	5,441	$14,546	5,931	$16,946	6,347	$20,018
Clays.....thousand short tons	167	83	160	102	184	112	219	131
Lime.....do	10	321	1	15	1	15	1	14
Salt.....do	3	38	(2)	(2)				
Sand and gravel.....do	530	888	8,996	8,669	11,370	10,385	7,378	9,793
Stone.....do	2,063	2,878	4,219	7,661	5,049	7,284	5,589	8,551
Value of items that cannot be disclosed: Other nonmetals and values indicated by footnote 2				74				
Total		[3] 21,190		[3] 31,067		[3] 34,742		38,507

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Revised figure.

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TABLE 8.—U.S. imports for consumption of principal minerals and products

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Metals:				
Aluminum:				
Metal—short tons	199,223	$91,187	307,521	$128,560
Scrap—do	6,002	1,738	6,496	1,864
Plates, sheets, bars, etc—do	49,310	33,062	59,188	37,147
Antimony:				
Ore (antimony content)—do	6,713	1,389	8,602	2,168
Needle or liquated—do	13	6	17	8
Metal—do	4,912	2,347	4,720	2,300
Oxide—do	1,980	935	2,910	1,391
Arsenic: White (As_2O_3 content)—do	19,483	1,422	15,758	1,077
Bauxite: Crude—thousand long tons	[1] 9,206	[2] 88,814	[1] 10,585	122,190
Beryllium ore—short tons	8,516	2,786	8,552	2,897
Bismuth (general imports)—pounds	798,518	1,498	816,190	1,478
Boron carbide—do	11,992	37	9,124	34
Cadmium:				
Metal—thousand pounds	1,079	1,473	1,117	1,640
Flue dust (cadmium content)—do	239	112	1,570	850
Calcium:				
Metal—pounds	17,266	23	43,962	52
Chloride—short tons	3,022	103	1,896	60
Chromate:				
Ore and concentrate (Cr_2O_3 content)—do	[2] 565,861	[2] 21,476	613,572	23,700
Ferrochrome (chromium content)—do	18,698	7,611	24,802	10,023
Metal—do	692	1,150	648	993
Cobalt:				
Metal—thousand pounds	10,036	14,867	[1] 11,814	[1] 17,129
Oxide (gross weight)—do	681	663	978	943
Salts and compounds (gross weight)—do	159	59	120	47
Columbium ore [1]—pounds	2,777,700	2,306	5,050,888	3,405
Copper: (copper content)				
Ore—short tons	2,587	1,526	116	202
Concentrates—do	21,914	12,516	2,206	1,212
Regulus, black, coarse—do	95	57	22	12
Unrefined, black, blister—do	5,929	3,508	1,119	669
Refined in ingots, etc—do	87,206	51,852	130,525	77,189
Old and scrap—do	1,643	870	3,846	2,242
Old brass and clippings—do	390	173	1,289	738
Ferroalloys: Ferrosilicon (silicon content)—do	2,307	803	2,573	976
Gold:				
Ore and base bullion—troy ounces	456,139	15,938	382,468	13,281
Bullion—do	1,159,320	40,273	3,929,718	137,652
Iron ore:				
Ore—thousand long tons	25,805	250,226	33,431	324,702
Pyrites cinder—long tons	3,504	18	4,248	26
Iron and steel:				
Pig iron—short tons	377,180	20,511	500,010	24,682
Iron and steel products (major):				
Iron products—do	31,157	5,794	54,132	10,634
Steel products—do	[2] 3,277,325	418,268	4,236,605	514,115
Scrap—do	235,350	8,315	[1] 189,035	[1] 5,726
Tinplate scrap—do	33,039	770	21,092	341
Lead:				
Ore, flue dust, matte (lead content)—do	[2] 136,780	[2] 24,332	133,867	21,137
Base bullion (lead content)—do	236	[1] 51	[1] 2,083	710
Pigs and bars (lead content)—do	[2] 247,427	[2] 45,881	257,866	41,570
Reclaimed, scrap, etc. (lead content)—do	3,894	592	2,078	269
Sheets, pipe, and shot—do	2,845	641	2,276	474
Babbitt metal and solder (lead content)—do	1,409	14,207	1,030	3,443
Type metal and antimonial lead (lead content)—short tons	5,765	1,340	7,512	1,393
Manufactures—do	2,319	807	2,021	978
Magnesium:				
Metallic and scrap—do	1,005	483	[1] 2,359	[1] 1,080
Alloys (magnesium content)—do	31	170	[1] 53	[1] 106
Sheets, tubing, ribbons, wire, and other forms (magnesium content)—short tons	5	80	35	83
Manganese:				
Ore (35 percent or more manganese) (manganese content)—short tons	1,031,062	78,144	943,659	66,149
Ferromanganese (manganese content)—do	170,199	34,396	97,042	16,631
Mercury:				
Compounds—pounds	90,724	228	46,368	105
Metal—76-pound flasks	[2] 12,326	2,048	31,652	5,102
Minor metals: Selenium and salts—pounds	127,482	738	160,389	866

See footnotes at end of table.

TABLE 8.—U.S. imports for consumption of principal minerals and products—Continued

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Metals—Continued				
Nickel:				
Ore and matte—short tons	(3)	(4)	14	$5
Pigs, ingots, shot, cathodes—do	115,985	$169,656	115,947	175,381
Scrap—do	278	175	601	545
Oxide—do	14,613	14,137	8,661	9,086
Platinum group:				
Unrefined materials:				
Ores and concentrates—troy ounces	568	39	----------	----------
Grains and nuggets, including crude, dust, and residues—troy ounces	[2] 31,614	[2] 2,288	23,366	1,610
Sponge and scrap—do	[2] 9,933	[2] 582	6,185	684
Osmiridium—do	2,601	66	24	1
Refined metal:				
Platinum—do	236,859	18,165	210,220	16,097
Palladium—do	571,693	12,672	431,872	9,370
Iridium—do	4,366	286	9,001	578
Osmium—do	466	26	1,062	55
Rhodium—do	17,394	2,328	30,123	3,965
Ruthenium—do	8,969	388	8,499	339
Radium:				
Radium salts—milligrams	12,947	185	46,962	700
Radioactive substitutes	(5)	1,509	(5)	1,732
Rare earths: Ferrocerium and other cerium alloys—pounds	22,955	63	20,608	60
Silver:				
Ore and base bullion—thousand troy ounces	34,559	30,832	37,168	35,814
Bullion—do	15,697	14,173	39,191	36,907
Tantalum: Ore[1]—pounds	1,004,151	2,002	1,211,757	3,527
Tin:				
Ore (tin content)—long tons	8,917	21,923	5,364	13,595
Blocks, pigs, grains, etc—do	[2] 39,893	[2] 96,896	[1] 41,408	[1] 103,124
Dross, skimmings, scrap, residues, and tin alloys, n.s.p.f—long tons	612	1,299	[1] 2,173	[1] 880
Tinfoil, powder, flitters, etc	(5)	676	(5)	819
Titanium:				
Ilmenite—short tons	[2] 207,151	[2] 5,018	166,434	4,470
Rutile—do	27,497	2,544	35,966	2,646
Metal—pounds	4,980,356	5,352	1,849,034	1,733
Ferrotitanium—do	364,721	93	240,326	88
Compounds and mixtures—do	18,044,423	3,536	11,758,373	2,334
Tungsten (tungsten content):				
Ore and concentrate—thousand pounds	2,123	1,983	3,977	2,870
Metal—pounds	55,613	139	497,054	938
Ferrotungsten—thousand pounds	340	422	534	531
Other alloys—pounds	9,955	15	41,807	47
Zinc:				
Ore (zinc content)—short tons	357,653	31,920	387,321	31,817
Blocks, pigs, and slabs—do	125,186	27,540	135,995	28,478
Sheets—do	1,183	354	1,315	367
Old, dross, and skimmings—do	1,410	178	2,768	406
Dust—do	86	28	909	207
Manufactures	(5)	787	(5)	1,139
Zirconium: Ore, including zirconium sand—short tons	33,805	873	30,872	845
Nonmetals:				
Abrasives: Diamonds (industrial)—carats	14,209,446	68,545	12,281,143	51,040
Asbestos—short tons	[2] 616,529	58,942	676,027	64,150
Barite:				
Crude and ground—do	615,128	5,690	736,867	6,012
Witherite (crude)—do	1,716	67	1,431	59
Chemicals—do	4,565	543	5,319	595
Bromine—pounds	300,491	196	461,108	245
Cement—376-pound barrels	3,620,685	9,225	5,759,426	13,241
Clays:				
Raw—short tons	153,833	2,955	129,631	2,475
Manufactured—do	2,339	[2] 100	2,598	66
Cryolite—do	13,814	1,194	12,472	933
Feldspar: Crude—long tons	24	2	33	1
Fluorspar—short tons	505,759	13,644	595,695	15,596
Gem stones:				
Diamonds—carats	3,114,073	193,275	2,402,721	191,634
Emeralds—do	227,284	2,090	196,649	2,798
Other	(5)	27,350	(5)	30,074
Graphite—short tons	29,748	1,332	39,528	1,783

See footnotes at end of table.

TABLE 8.—U.S. imports for consumption of principal minerals and products—Continued

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Nonmetals—Continued				
Gypsum:				
Crude, ground, calcined short tons	4,968,188	$9,094	5,422,656	$10,545
Manufactures	(5)	1,212	(5)	1,367
Iodine, crude thousand pounds	3,017	2,852	3,026	2,841
Kyanite short tons	5,415	244	5,281	234
Lime:				
Hydrated do	950	22	1,141	19
Other do	31,418	491	71,970	939
Dead-burned dolomite do	4,256	233	4,456	245
Magnesium:				
Magnesite do	56,521	3,839	107,169	5,939
Compounds do	15,435	518	14,860	589
Mica:				
Uncut sheet and punch pounds	852,648	1,841	1,107,929	1,789
Scrap short tons	3,024	41	4,458	55
Manufactures do	[2] 3,763	[2] 6,115	5,403	7,922
Mineral-earth pigments: Iron oxide pigments:				
Natural do	2,248	114	2,937	128
Synthetic do	4,806	777	6,206	960
Ocher, crude and refined do	91	5	146	9
Siennas, crude and refined do	546	57	879	84
Umber, crude and refined do	2,685	93	2,663	94
Vandyke brown do	168	13	256	21
Nitrogen compounds (major), including urea do	[2] 1,437,178	[2] 63,399	1,559,689	69,260
Phosphate, crude long tons	134,004	3,629	133,628	3,551
Phosphatic fertilizers do	32,467	2,453	83,894	4,630
Pigments and salts:				
Lead pigments and salts short tons	18,155	3,498	18,986	3,027
Zinc pigments and salts do	12,608	[2] 2,348	15,282	2,729
Potash [6] do	[2] 465,007	[2] 17,315	620,236	21,864
Pumice:				
Crude and unmanufactured do	6,907	69	7,136	70
Wholly or partly manufactured do	4,063	116	3,184	89
Manufactures, n.s.p.f	(5)	19	(5)	22
Quartz crystal (Brazilian pebble) pounds	1,173,560	798	935,927	843
Salt short tons	1,050,084	3,755	1,374,219	5,097
Sand and gravel:				
Glass sand do	2	2	31,416	64
Other sand do	335,005	441	307,637	415
Gravel do	43,287	44	29,198	32
Sodium sulfate thousand short tons	196	4,153	188	3,768
Stone, including slate and whiting	(5)	12,268	(5)	17,204
Strontium: Mineral short tons	9,931	244	7,489	189
Sulfur and pyrites:				
Sulfur:				
Ore long tons	94,181	1,934	448,132	8,618
Other forms, n.e.s do	737,336	15,218	601,301	11,957
Pyrites do	281,604	742	301,899	747
Talc: Unmanufactured short tons	[2] 27,362	[2] 1,055	25,777	1,069
Fuels:				
Carbon black:				
Acetylene pounds	8,073,544	1,482	7,883,462	1,384
Gas black and carbon black do	557,327	111	284,296	49
Coal:				
Anthracite short tons	792	10	7,583	63
Bituminous, slack, culm, and lignite do	164,259	1,360	232,424	1,858
Briquets do	7,338	370	8,396	410
Coke do	126,518	1,543	141,883	1,855
Peat:				
Fertilizer grade do	243,834	12,620	261,347	12,448
Poultry and stable grade do	8,603	558	6,331	420
Petroleum:				
Crude [7] thousand barrels	411,968	933,310	450,157	1,011,914
Gasoline [8] do	[2] 17,354	[2] 57,089	33,369	102,455
Kerosine [9] do	425	1,524	3	8
Distillate oil [10] do	[2] 14,748	[2] 43,916	271,159	575,463
Residual oil [10] do	[2] 240,106	[2] 521,744		
Unfinished oils [11] do	25,802	69,978	21,527	57,224
Asphalt do	6,728	15,646	6,698	15,845
Miscellaneous [7] do	20	465	30	421

See footnotes on page 181.

[1] Adjusted by Bureau of Mines.
[2] Revised figure.
[3] Less than 1 ton.
[4] Less than $1,000.
[5] Weight not recorded.
[6] Data covers some quantities furnished by Potash Institute; values adjusted by Bureau of Mines.
[7] Includes some quantities imported free for supplies of vessels and aircraft.
[8] Includes naphtha, but excludes benzol: 1961—460,839 barrels ($5,476,518); 1962—547,537 barrels ($4,927,771).
[9] Includes quantities imported free for supplies of vessels and aircraft, assumed to be commercial jet fuel by Bureau of Mines.
[10] Effective July 1, 1962, distillate and residual fuel oil not separately classified.
[11] Due to changes in classification effective July 1, 1962, data not strictly comparable to earlier years.

Compiled by Mae B. Price and Elsie D. Jackson, Division of Foreign Activities, Bureau of Mines, from records of the U.S. Department of Commerce, Bureau of the Census.

TABLE 9.—U.S. exports of principal minerals and products

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Metals:				
Aluminum:				
Ingots, slabs, crude—short tons	128,861	$57,638	151,250	$66,621
Scrap—do	82,005	26,452	65,534	20,183
Plates, sheets, bars, etc—do	25,241	23,975	40,069	32,931
Castings and forgings—do	1,203	3,560	1,540	5,522
Antimony: Metals and alloys, crude—do	34	21	35	15
Arsenic: Calcium arsenate—pounds	669,932	58	942,399	104
Bauxite, including bauxite concentrates—long tons	150,683	12,189	258,561	19,874
Aluminum sulfate—short tons	14,213	535	17,776	608
Other aluminum compounds—do	[1] 55,650	[1] 8,128	87,671	10,936
Beryllium—pounds	123,349	645	63,975	352
Bismuth: Metals and alloys—do	167,166	268	118,056	176
Cadmium—thousand pounds	702	983	717	1,139
Calcium chloride—short tons	22,047	1,091	43,830	1,687
Chrome:				
Ore and concentrate:				
Exports—do	[1] 5,201	[1] 345	2,686	108
Reexports—do	[1] 35,890	[1] 1,373	51,254	2,033
Chromic acid—do	1,068	604	834	487
Ferrochrome—do	7,844	2,838	3,075	1,182
Cobalt—pounds	2,075,243	1,881	1,936,487	997
Columbium metals, alloys, and other forms—short tons	69,863	151	38,157	277
Copper:				
Ore, concentrate, composition metal, and unfined copper (copper content)—short tons	4,478	2,475	1,916	1,045
Refined copper and semimanufactures—do	[1] 482,824	295,397	366,585	234,605
Other copper manufactures—do	7,362	5,260	6,768	5,107
Copper sulfate or blue vitriol—do	7,575	1,542	1,916	456
Copper-base alloys—do	124,938	70,240	46,030	36,024
Ferroalloys:				
Ferrosilicon—pounds	69,528,561	6,105	8,202,626	1,349
Ferrophosphorus—do	[1] 65,720,159	[1] 1,426	28,260,782	595
Gold:				
Ore and base bullion—troy ounces	13,717	480	22,724	809
Bullion, refined—do	22,132,692	774,521	10,861,510	380,153
Iron ore—thousand long tons	[1] 4,958	[1] 54,230	5,898	62,833
Iron and steel:				
Pig iron—short tons	415,668	19,243	154,380	8,283
Iron and steel products (major):				
Semimanufactures—do	[1] 1,428,369	[1] 274,343	1,505,740	282,536
Manufactured steel mill products—do	[1] 792,788	[1] 252,406	761,045	262,220
Advanced products—do	(2)	[1] 159,847	(2)	174,571
Iron and steel scrap: Ferrous scrap, including rerolling materials—short tons	[1] 9,713,863	[1] 353,928	5,113,409	148,973
Lead:				
Ore, matte, base bullion (lead content)—do	4,437	448	2,898	235
Pigs, bars, anodes—do	2,133	518	2,108	528
Scrap—do	5,163	940	2,461	457
Magnesium:				
Metal and alloys and semimanufactured forms, n.e.c—short tons	6,648	4,519	7,020	4,659
Powder—do	33	78	21	53
Manganese:				
Ore and concentrate—do	7,528	1,054	8,643	1,012
Ferromanganese—do	469	146	4,114	629
Mercury:				
Exports—76-pound flasks	285	71	224	64
Reexports—do	180	33	257	43
Molybdenum:				
Ore and concentrate (molybdenum content)—pounds	35,661,001	48,758	15,554,662	22,901
Metals and alloys, crude and scrap—do	440,849	433	75,211	70
Wire—do	12,488	376	12,088	374
Semifabricated forms, n.e.c—do	7,362	135	8,961	135
Powder—do	11,816	40	25,219	84
Ferromolybdenum—do	358,523	501	189,823	305
Nickel:				
Ore—short tons	1,766	495	45	16
Alloys and scrap (including Monel metal), ingots, bars, sheets, etc—short tons	51,631	24,969	25,510	20,796
Catalysts—do	805	1,456	1,093	1,963
Nickel-chrome electric resistance wire—do	254	1,079	190	965
Semifabricated forms, n.e.c—do	1,037	3,980	803	3,463

See footnotes at end of table.

TABLE 9.—U.S. exports of principal minerals and products—Continued

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Metals—Continued				
Platinum:				
Ore, concentrate, metal and alloys in ingots, bars, sheets, anodes, and other forms, including scrap—troy ounces	41,385	$2,089	49,651	$1,514
Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium (metal and alloys including scrap)—troy ounces	20,460	820	10,940	459
Platinum-group manufactures, except jewelry	(2)	2,983	(2)	4,106
Radium metal (radium content)—milligrams	334	18	328	4
Rare earths:				
Cerium ore, metal, and alloys—pounds	6,563	30	3,708	16
Lighter flints—do	20,338	89	38,501	173
Silver:				
Ore and base bullion—thousand troy ounces	654	597	770	789
Bullion, refined—do	39,174	36,361	12,287	12,586
Tantalum:				
Ore, metal, and other forms—pounds	[1] 135,321	[1] 990	[3] 54,256	[3] 716
Powder—do	5,585	189	[3] 7,445	[3] 353
Tin:				
Ingots, pigs, bars, etc.:				
Exports—long tons	543	1,264	335	840
Reexports—do	257	626	100	267
Tin scrap and other tin-bearing material except tinplate scrap—long tons	10,506	3,352	5,587	2,111
Tin cans, finished or unfinished—do	30,929	15,093	25,531	13,927
Titanium:				
Ore and concentrate—short tons	1,436	190	1,224	167
Sponge (including iodide titanium) and scrap—short tons	886	927	818	925
Intermediate mill shapes—do	336	1,929	453	2,609
Mill products, n.e.c.—do	48	773	108	1,493
Ferrotitanium—do	212	93	130	95
Dioxide and pigments—do	31,104	9,216	29,095	8,636
Tungsten: Ore and concentrate:				
Exports—short tons	207	250	40	80
Reexports—do	689	791	[3] 159	132
Vanadium ore and concentrate, pentoxide, etc. (vanadium content)—pounds	4,161,978	[1] 7,660	2,018,957	2,961
Zinc:				
Ore and concentrate (zinc content)—short tons	1,670	124	136	46
Slabs, pigs, or blocks—do	50,055	11,196	36,102	8,050
Sheets, plates, strips, or other forms, n.e.c.—short tons	3,219	2,271	3,547	2,391
Scrap (zinc content)—do	5,900	871	7,940	956
Dust—do	717	224	676	240
Semifabricated forms, n.e.c.—do	3,036	1,317	1,613	1,254
Zirconium:				
Ore and concentrate—do	1,277	278	1,666	365
Metals and alloys and other forms—pounds	178,873	1,472	[4] 216,247	[4] 1,742
Nonmetals:				
Abrasives:				
Grindstones—short tons	123	46	127	53
Diamond dust and powder—carats	490,327	1,357	828,611	2,225
Diamond grinding wheels—do	285,425	1,708	310,330	1,990
Other natural and artificial metallic abrasives and products	(2)	[1] 26,098	(2)	28,489
Asbestos: Unmanufactured:				
Exports—short tons	3,572	708	2,824	578
Reexports—do	227	51	125	20
Boron: Boric acid, borates, crude and refined—pounds	538,542,810	23,212	584,528,807	24,736
Bromine, bromides, and bromates—do	11,120,085	2,980	8,800,351	2,228
Cement—376-pound barrels	285,816	1,387	380,383	1,853
Clays:				
Kaolin or china clay—short tons	98,785	2,395	118,890	2,939
Fire clay—do	155,166	3,391	188,282	3,462
Other clays—do	304,858	8,499	309,776	10,454
Cryolite—do	167	41	1,109	196
Fluorspar—do	338	30	1,308	119
Graphite:				
Amorphous—do	1,328	186	746	110
Crystalline flake, lump or chip—do	91	34	127	42
Natural, n.e.c.—do	139	37	286	71

See footnotes at end of table.

TABLE 9.—U.S. exports of principal minerals and products—Continued

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Nonmetals—Continued				
Gypsum:				
Crude, crushed or calcined thousand short tons	20	$731	20	$736
Manufactures, n.e.c	(2)	568	(2)	566
Iodine, iodide, iodates thousand pounds	176	282	178	296
Kyanite and allied minerals short tons	4,000	318	3,568	287
Lime do	29,969	921	19,512	660
Mica:				
Unmanufactured pounds	334,221	142	430,856	166
Manufactured:				
Ground or pulverized do	7,074,850	396	7,427,420	432
Other do	190,320	689	197,441	765
Mineral-earth pigments: Iron oxide, natural and manufactured short tons	3,213	855	3,754	1,076
Nitrogen compounds (major) do	445,930	30,480	911,037	43,847
Phosphate rock long tons	4,122,732	36,910	4,239,120	38,833
Phosphatic fertilizers (superphosphates) do	469,197	23,695	558,188	27,690
Pigments and salts (lead and zinc):				
Lead pigments short tons	2,302	764	1,919	595
Zinc pigments do	2,791	759	2,411	658
Lead salts do	464	183	711	249
Potash:				
Fertilizer do	[1] 773,410	[1] 29,481	847,949	28,373
Chemical do	29,740	2,995	13,171	2,435
Quartz crystal (raw)	(2)	518	(2)	448
Radioactive isotopes, etc curies	202,769	1,741	226,824	1,895
Salt:				
Crude and refined short tons	641,966	3,876	665,202	3,616
Shipments to noncontiguous Territories do	10,164	793	11,347	823
Sodium and sodium compounds:				
Sodium sulfate do	32,259	992	50,914	1,486
Sodium carbonate thousand short tons	132	4,045	152	4,693
Stone:				
Limestone, crushed, ground, broken short tons	790,912	1,596	621,177	1,547
Marble and other building and monumental do	435,173	1,596	534,919	1,795
Stone, crushed, ground, broken do	128,149	3,027	114,744	2,166
Manufactures of stone	(2)	430	(2)	501
Sulfur:				
Crude long tons	1,585,531	35,370	1,537,419	35,496
Crushed, ground, flowers of do	10,512	1,254	16,567	1,799
Talc:				
Crude and ground short tons	47,912	1,721	46,939	2,133
Manufactures, n.e.c do	134	84	122	97
Powders—talcum (face and compact)	(2)	1,396	(2)	1,286
Fuels:				
Carbon black thousand pounds	522,331	48,166	442,437	41,801
Coal:				
Anthracite short tons	[1] 1,435,335	[1] 20,681	1,869,408	25,666
Bituminous do	34,969,825	319,034	38,413,424	351,320
Briquets do	12,731	176	18,596	233
Coke do	445,232	8,213	394,296	7,424
Petroleum:				
Crude thousand barrels	3,219	8,541	1,793	5,085
Gasoline [5] do	8,209	56,481	5,987	41,339
Kerosine do	210	1,462	312	1,817
Distillate oil do	6,838	23,594	8,918	30,071
Residual oil do	14,023	34,575	12,852	32,832
Lubricating oil do	[1] 16,605	218,388	17,165	225,480
Asphalt do	[1] 535	[1] 4,081	717	4,572
Liquefied petroleum gases do	3,549	13,322	3,875	11,250
Wax do	1,238	24,694	1,430	28,484
Coke do	7,271	29,234	7,456	29,357
Petrolatum do	246	6,098	238	6,151
Miscellaneous do	476	14,292	476	15,423

[1] Revised figure.
[2] Weight not recorded.
[3] Adjusted by Bureau of Mines.
[4] Final figure. Supersedes figure given in commodity chapter.
[5] Includes naphtha, but excludes benzol: 1961—1,106,390 barrels ($16,877,309); 1962—982,361 barrels ($12,027,669).

Compiled by Mae B. Price and Elsie D. Jackson, Division of Foreign Activities, Bureau of Mines, from records of the U.S. Department of Commerce, Bureau of the Census.

TABLE 10.—Comparison of world and U.S. production of principal metals and minerals

Mineral	1961			1962		
	World	United States		World	United States	
	Thousand short tons (unless otherwise stated)		Percent of world	Thousand short tons (unless otherwise stated)		Percent of world
Fuels:						
Coal:						
Bituminous	1,960,631	399,959	20	2,002,401	419,094	20
Lignite	729,510	3,018	(1)	758,936	3,055	(1)
Pennsylvania anthracite	189,900	17,446	9	191,900	16,894	9
Coke (excluding breeze):						
Gashouse [2]	49,430	(3)	(3)	49,540	(3)	(3)
Oven and beehive	304,470	51,711	17	301,474	51,910	17
Fuel briquets and packaged fuel	123,100	591	(1)	127,800	587	(1)
Natural gas (marketable) million cubic feet	(4)	13,254,025	(4)	(4)	13,876,622	(4)
Peat	166,200	531	(1)	169,700	572	(1)
Petroleum (crude) thousand barrels	8,186,246	2,621,758	32	8,878,881	2,676,185	30
Nonmetals:						
Asbestos	2,770	53	2	3,055	53	2
Barite	2,960	731	25	3,310	887	27
Cement [5] thousand barrels	1,967,606	397,003	20	2,095,654	414,582	20
China clay	(4)	2,740	(4)	(4)	2,998	(4)
Corundum	8			9		
Diamonds thousand carats	34,250			32,876		
Diatomite	1,450	482	33	1,440	482	33
Feldspar thousand long tons	1,490	497	33	1,500	492	33
Fluorspar	2,345	197	8	2,405	206	9
Graphite	440	(3)	(3)	570	(3)	(3)
Gypsum	48,320	9,500	20	49,965	9,969	20
Lime (sold or used by producers)	(4)	13,265	(4)	(4)	13,752	(4)
Magnesite	8,450	604	7	8,200	492	6
Mica (including scrap) thousand pounds	365,000	198,614	54	400,000	215,765	54
Nitrogen, agricultural [5 6]	11,900	2,739	23	12,790	2,936	23
Phosphate rock thousand long tons	43,670	18,559	42	46,040	19,382	42
Potash (K_2O equivalent)	10,700	2,732	26	10,700	2,452	23
Pumice [7]	13,300	2,463	19	13,600	2,297	17
Pyrites thousand long tons	19,800	987	5	20,100	916	5
Salt [5]	94,100	25,707	27	100,500	28,807	29
Strontium [7]	14			10		
Sulfur, elemental thousand long tons	11,275	6,336	56	11,640	5,925	51
Talc, pyrophyllite, and soapstone	2,940	762	26	2,930	772	26
Vermiculite [7]	279	206	74	293	205	70
Metals, mine basis:						
Antimony (content of ore and concentrate) short tons	60,000	689	1	60,000	631	1
Arsenic, white [7]	54	(3)	(3)	56	(3)	(3)
Bauxite thousand long tons	28,805	1,228	4	29,940	1,369	5
Beryllium concentrate short tons	9,300	1,122	12	8,200	978	12
Bismuth thousand pounds	5,300	(3)	(3)	7,000	(3)	(3)
Cadmium do	26,400	10,115	38	25,600	10,641	42
Chromite	4,720	[8] 82	2	4,805		
Cobalt (contained) [7] short tons	14,800	(3)	(3)	15,700	(3)	(3)
Columbium-tantalum concentrate [7] thousand pounds	7,480			8,250		
Copper (content of ore and concentrate)	4,840	1,165	24	5,050	1,228	24
Gold thousand troy ounces	47,400	1,567	3	50,000	1,556	3
Iron ore thousand long tons	503,779	71,329	14	504,012	71,829	14
Lead (content of ore and concentrate)	2,625	262	10	2,765	237	9
Manganese ore (35 percent or more Mn)	15,073	46	(1)	15,590	25	(1)
Mercury thousand 76-pound flasks	240	32	13	244	26	11
Molybdenum (content of ore and concentrate) thousand pounds	87,900	66,563	76	75,000	51,244	68
Nickel (content of ore and concentrate)	394	11	3	401	11	3
Platinum group metals thousand troy ounces	1,205	43	4	1,190	29	2
Silver do	236,500	34,900	15	242,400	36,345	15
Tin (content of ore and concentrate) long tons	185,200	(3)	(3)	190,200	(3)	(3)
Titanium concentrates:						
Ilmenite [7]	2,327	782	34	2,295	808	35
Rutile [7]	129	9	7	151	10	7
Tungsten concentrate (60 percent WO_3) short tons	73,800	8,245	11	71,100	8,429	12

See footnotes at end of table.

TABLE 10.—Comparison of world and U.S. production of principal metals and minerals—Continued

Mineral	1961			1962		
	World	United States		World	United States	
	Thousand short tons (unless otherwise stated)		Percent of world	Thousand short tons (unless otherwise stated)		Percent of world
Metals, mine basis—Continued						
Vanadium (content of ore and concentrate)[7] short tons	8,871	5,343	60	8,350	5,233	63
Zinc (content of ore and concentrate)	3,770	464	12	3,870	505	13
Metals, smelter basis:						
Aluminum	5,210	1,904	37	5,555	2,118	38
Copper	5,090	1,207	24	5,300	1,322	25
Iron, pig (including ferroalloys)	287,350	66,717	23	294,200	67,636	23
Lead	2,665	449	17	2,665	376	14
Magnesium short tons	115,100	40,745	35	145,300	68,955	47
Selenium[7] thousand pounds	2,097	1,022	49	2,126	999	47
Steel ingots and castings	390,400	98,014	25	397,350	98,328	25
Tellurium[7] thousand pounds	366	205	56	398	264	66
Tin thousand long tons	189	[9] 9	5	196	[9] 5	3
Uranium oxide (U_3O_8)[7] short tons	36,080	17,399	48	33,550	17,010	51
Zinc	3,560	847	23	3,650	879	24

[1] Less than 1 percent.
[2] Includes low- and medium-temperature and gashouse coke.
[3] Bureau of Mines not at liberty to publish U.S. figure separately.
[4] Data not available.
[5] Including Puerto Rico.
[6] Year ended June 30 of year stated (United Nations).
[7] World total exclusive of U.S.S.R.
[8] Produced for Federal Government only; excludes quantity consumed by American Chrome Company.
[9] U.S. imports of tin concentrates (tin content).

Compiled by Liela S. Price, Division of Foreign Activities.

Employment and Injuries in the Mineral Industries

By Forrest T. Moyer[1]

THIS CHAPTER of the Minerals Yearbook (Volume III) contains overall injury experience for coal mines, both anthracite and bituminous coal, coke plants, petroleum and natural gas, peat, and asphalt and related bitumens (native); metal mines, metallurgical plants, including ore-dressing plants and primary nonferrous reduction plants and refineries; nonmetal mines; nonmetal mills; sand and gravel operations; slag (iron blast-furnace) plants; and stone quarries and their related plants. Volume I of the yearbook contains a chapter showing injury experience and employment data treated separately by categories: Metal mines, nonmetal mines, quarries and their related plants, metallurgical plants (ore-dressing plants and primary nonferrous reduction plants and refineries are shown separately), nonmetal mills, sand and gravel plants, and iron blast-furnace slag plants. Volume II contains injury and employment experience in the fuel industries (anthracite, bituminous coal including lignite, coke, petroleum and natural gas, native asphalt and related bitumens, and peat).

Injury and employment data were collected from coal producers on the regular mandatory basis as required by the Federal Coal Mine Safety Act (30 U.S.C., sec. 455). Similar data for 1962 from metal, nonmetal (except well and brine operations), stone, and sand and gravel producers were collected by a mandatory reporting system under the provisions of the Act of September 26, 1961, Public Law 87–300 (75 Stat. 649). Before 1962, these nonfuel producers reported voluntarily to the Bureau of Mines. Producers of all other minerals (fuel and nonfuel) reported the requested injury and employment data voluntarily to the Bureau for 1962, the same as in preceding years.

Data presented for 1962 are preliminary except for anthracite, coke, petroleum and natural gas, peat, native asphalt, and slag. The preliminary data, with the exception of those for bituminous coal, is based on reports received by April 15, 1963, from the operators who supply the requested information on employment and injuries. No estimates of injury experience and employment are included in these preliminary figures.

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[1] Chief, Branch of Accident Analysis, Division of Accident Prevention and Health.

The safety record of the mineral industries for 1962 was slightly improved as indicated by the 2-percent decline in the combined (fatal and nonfatal) injury-frequency rate. Although fewer nonfatal injuries were reported, the number of fatal injuries increased appreciably due principally to two single accidents in each of which several men were killed. The average hours worked in 1962 were 2,022, approximately the same as in 1961 (2,011).

Two major disasters (defined as a single accident in which five or more men are killed) occurred in bituminous coal mines in 1962. Both were caused by explosions of mine gases. One at Herrin, Williamson County, Ill., killed 11 men, and the other at Carmichaels, Greene County, Pa., killed 37 men.

Work Stoppages.—The U.S. Department of Labor, Bureau of Labor Statistics, reported 165 work stoppages in 1962 in certain mineral industry groups with a total of approximately 1,500,000 man-days of work lost. Although there was a 1-percent decrease from 1961 in the number of stoppages, the days of work lost more than doubled the number lost the preceding year. The bituminous coal mining industry had 121 stoppages in 1962, and anthracite had 8. The work-time lost in the two industries were respectively 191,000 and 15,000 man-days. The petroleum refining industry, copper, and chemical and fertilizer mineral mining, each had 5 work stoppages with respective man-day losses of 516,000, 129,000 and 169,000 days of work. Lead-zinc mining had 4 stoppages with 160,000 man-days lost; the dimension-stone industry and iron mining each had 3 stoppages with respectively 75,000 and 17,000 man-days lost. The ferroalloy metal ore industry reported one stoppage with a loss of 211,000 days. The total of these groups accounted for 155 or 94 percent of the total stoppages for the year and 1,483,000 man-days or 99 percent of the total days lost in 1962. The remaining 10 stoppages were in the gold-silver, crushed stone, sand and gravel and clay and hydraulic cement industries.

TABLE 1.—Salient statistics of injury experience and employment data in the mineral industries of the United States, by industry groups

	1958	1959	1960	1961	1962 [1]
Average number of men working daily: [2]					
Coal mines	224,890	203,597	189,679	167,568	159,110
Coke plants	16,186	16,645	16,463	13,534	13,080
Petroleum and natural gas [3]	584,708	559,244	511,107	452,721	469,256
Peat [4]	464	467	576	765	683
Asphalt and related bitumens (nat.) [5]			445	383	358
Metal mines	59,608	58,557	60,595	54,251	50,409
Nonmetal mines (except stone quarries)	17,820	18,765	18,653	18,281	16,156
Sand and gravel operations [4]	51,122	59,492	52,352	55,726	39,700
Stone quarries	88,448	91,523	95,304	91,371	80,685
Slag (iron blast-furnace) [6]	1,882	1,789	1,680	1,682	1,462
Metallurgical plants	52,109	55,655	58,689	56,065	47,319
Nonmetal mills	32,401	40,800	39,568	39,031	30,565
Total	1,129,638	1,106,534	1,045,111	951,378	908,783
Average number of active mine days:					
Coal mines	183	186	189	194	201
Coke plants	351	328	350	354	359
Petroleum and natural gas [3]	260	(7)	(7)	(7)	(7)
Peat	171	178	169	156	169
Asphalt and related bitumens (nat.) [5]			264	256	279
Metal mines	229	214	246	247	252
Nonmetal mines (except stone quarries)	239	239	242	238	240
Sand and gravel operations [4]	211	(7)	(7)	217	213
Stone quarries	264	(7)	(7)	257	258
Slag (iron blast-furnace) [6]	248	254	(7)	246	248
Metallurgical plants	302	289	309	315	314
Nonmetal mills	272	274	270	268	253
Total	244				
Man-days worked, in thousands:					
Coal mines	41,121	37,773	35,778	32,551	31,922
Coke plants	5,683	5,467	5,768	4,791	4,691
Petroleum and natural gas [3]	151,965	(7)	(7)	(7)	(7)
Peat [4]	79	83	97	120	116
Asphalt and related bitumens (nat.) [5]			117	98	100
Metal mines	13,665	12,503	14,910	13,416	12,704
Nonmetal mines (except stone quarries)	4,258	4,488	4,515	4,347	3,879
Sand and gravel operations [4]	10,763	(7)	(7)	12,117	8,456
Stone quarries	23,353	(7)	(7)	23,524	20,807
Slag (iron blast-furnace) [6]	467	455	(7)	415	362
Metallurgical plants	15,733	16,095	18,149	17,669	14,355
Nonmetal mills	8,809	11,195	10,679	10,471	7,742
Total [8]	275,895	88,060	90,013	119,517	105,634
Man-hours worked, in thousands:					
Coal mines	322,229	296,031	281,528	255,296	250,730
Coke plants	45,486	43,626	46,066	38,306	37,502
Petroleum and natural gas [3]	1,215,722	1,185,146	1,063,332	951,743	984,172
Peat [4]	704	738	866	1,038	977
Asphalt and related bitumens (nat.) [5]			948	792	800
Metal mines	109,523	100,576	119,653	107,678	102,090
Nonmetal mines (except stone quarries)	34,648	36,334	36,805	35,517	31,681
Sand and gravel operations [4]	92,456	109,830	95,749	101,707	72,890
Stone quarries	186,821	199,321	202,366	192,705	172,109
Slag (iron blast-furnace) [6]	3,776	3,681	3,613	3,361	2,927
Metallurgical plants	125,773	128,913	145,210	141,415	118,073
Nonmetal mills	71,161	90,706	86,386	83,925	63,662
Total [8]	2,208,298	2,194,902	2,082,521	1,913,481	1,837,610
Number of injuries:					
Fatal:					
Coal mines	358	293	325	294	287
Coke plants	5	3	3	3	11
Petroleum and natural gas [3] [9]	116	120	82	111	121
Peat [4]		1			
Asphalt and related bitumens (nat.) [5]			1	1	

See footnotes at end of table.

TABLE 1.—Salient statistics of injury experience and employment data in the mineral industries of the United States, by industry groups—Continued

	1958	1959	1960	1961	1962 [1]
Number of injuries—Continued					
Fatal—Continued					
Metal mines	70	73	84	50	61
Nonmetal mines (except stone quarries)	15	11	19	15	14
Sand and gravel operations [4]	25	21	25	21	52
Stone quarries	45	52	39	32	65
Slag (iron blast-furnace) [6]	1	1			
Metallurgical plants	12	11	12	9	23
Nonmetal mills	9	11	13	6	9
Total	656	597	603	542	643
Nonfatal:					
Coal mines	14,160	12,163	11,902	11,197	11,211
Coke plants	210	222	223	193	252
Petroleum and natural gas [3] [9]	11,588	10,543	9,110	8,697	9,336
Peat [4]	12	14	24	17	19
Asphalt and related bitumens (nat.) [5]			38	30	13
Metal mines	3,499	3,281	3,794	3,669	3,201
Nonmetal mines (except stone quarries)	955	1,072	1,056	861	924
Sand and gravel operations [4]	1,698	2,161	1,919	1,814	1,542
Stone quarries	4,572	4,790	4,668	4,280	2,872
Slag (iron blast-furnace) [6]	43	43	34	30	29
Metallurgical plants	1,698	1,305	1,482	1,705	1,336
Nonmetal mills	1,490	2,156	1,794	1,680	1,250
Total	39,925	37,750	36,044	34,173	31,985
Injury rates per million man-hours:					
Fatal:					
Coal mines	1.11	0.99	1.15	1.15	1.14
Coke plants	.11	.07	.07	.08	.29
Petroleum and natural gas [3] [9]	.10	.10	.08	.12	.12
Peat [4]		1.36			
Asphalt and related bitumens (nat.) [5]			1.06	1.26	
Metal mines	.64	.73	.70	.46	.60
Nonmetal mines (except stone quarries)	.43	.30	.52	.42	.44
Sand and gravel operations [4]	.27	.19	.26	.21	.71
Stone quarries	.24	.26	.19	.17	.38
Slag (iron blast-furnace) [6]	.26	.27			
Metallurgical plants	.10	.09	.08	.06	.19
Nonmetal mills	.13	.12	.15	.07	.14
Total	.30	.27	.29	.28	.35
Nonfatal:					
Coal mines	43.94	41.09	42.28	43.86	44.71
Coke plants	4.62	5.09	4.84	5.04	6.72
Petroleum and natural gas [3] [9]	9.53	8.90	8.57	9.14	9.49
Peat [4]	17.05	18.97	27.72	16.38	19.46
Asphalt and related bitumens (nat.) [5]			40.10	37.90	16.25
Metal mines	31.95	32.62	31.71	34.07	31.35
Nonmetal mines (except stone quarries)	27.56	29.50	28.69	24.24	29.17
Sand and gravel operations [4]	18.37	19.68	20.04	17.84	21.16
Stone quarries	24.47	24.03	23.07	22.21	16.69
Slag (iron blast-furnace) [6]	11.39	11.68	9.41	8.93	9.91
Metallurgical plants	13.50	10.12	10.21	12.06	11.32
Nonmetal mills	20.94	23.77	20.77	20.02	19.64
Total	18.08	17.20	17.31	17.86	17.41

[1] Preliminary figures, except anthracite, coke, petroleum and natural gas, peat, native asphalt, and slag.
[2] Men at work each day mine was active.
[3] Includes officeworkers; separate data not available.
[4] Peat and sand and gravel canvasses included beginning 1957.
[5] Asphalt and related bitumens (nat.) canvass shown separately and included with fuels beginning 1960, formerly included with nonmetals.
[6] Slag (iron-blast furnace) canvass included beginning 1958.
[7] Data not available.
[8] Data may not add to totals shown because of rounding.
[9] Permanent total injuries are combined with fatalities

TABLE 2.—Work stoppages in certain mineral industries in the United States

Industry and year	Work stoppages	
	Number	Man-days lost (thousands)
Coal mining:		
Anthracite:		
1958	8	2.1
1959	1	1.2
1960	6	9.3
1961	5	4.2
1962	8	14.6
Bituminous:		
1958	136	102.0
1959	146	[1] 1,560.0
1960	120	[1] 137.0
1961	117	90.7
1962	121	191.0
Coke and byproducts, coke only:		
1958	[2]	[2]
1959	[2]	[2]
1960	[2]	[2]
1961	[2]	[2]
1962	[2]	[2]
Petroleum refining:		
1958	8	124.0
1959	13	543.0
1960	2	[1] 48.2
1961	9	310.0
1962	5	516.0
Metal mining:		
Iron:		
1958	1	9.7
1959	8	2,120.0
1960	2	15.2
1961	2	4.2
1962	3	17.4
Copper:		
1958	2	22.0
1959	9	1,800.0
1960	1	[1] 361.0
1961	4	106.0
1962	5	129.0
Lead-zinc:		
1958	------	------
1959	5	28.0
1960	3	58.8
1961	4	18.0
1962	4	160.0
Gold-silver:		
1958	------	------
1959	------	------
1960	------	------
1961	1	2.1
1962	1	8.8
Bauxite and other aluminum ores:		
1958	------	------
1959	------	------
1960	------	------
1961	------	------
1962	------	------
Ferroalloy metal ores:		
1958	2	84.2
1959	1	[3]
1960	1	[3]
1961	1	5.5
1962	1	211.0
Metal mining services:		
1958	------	------
1959	1	[3]
1960	------	------
1961	------	------
1962	------	------
Metal mining—Continued		
Miscellaneous metal ores:		
1958	2	1.5
1959	2	2.0
1960	2	2.3
1961	2	44.4
1962	------	------
Mining and quarrying of nonmetallic minerals (except fuels):		
Dimension stone:		
1958	2	14.3
1959	------	------
1960	1	2.5
1961	1	2.6
1962	3	74.5
Crushed and broken stone:		
1958	7	5.7
1959	8	76.9
1960	13	104.0
1961	7	2.8
1962	4	6.3
Sand and gravel:		
1958	2	25.2
1959	3	[1] 11.1
1960	3	1.8
1961	4	4.3
1962	3	2.0
Clay, ceramic and refractory minerals:		
1958	[1]	[3]
1959	2	1.2
1960	------	------
1961	2	1.9
1962	1	[3]
Chemical and fertilizer mineral mining:		
1958	5	32.5
1959	3	45.5
1960	2	7.3
1961	3	17.6
1962	5	169.0
Nonmetallic minerals (except fuels) services:		
1958	------	------
1959	------	------
1960	------	------
1961	------	------
1962	------	------
Miscellaneous nonmetallic minerals (except fuels):		
1958	1	2.5
1959	------	------
1960	------	------
1961	------	------
1962	------	------
Cement, hydraulic:		
1958	6	38.6
1959	8	74.8
1960	2	[1] 3.6
1961	5	4.9
1962	1	[3]

[1] Includes idleness from stoppages that began in previous year.
[2] Data not available.
[3] Less than 1,000 man-days.

Source: U.S. Department of Labor, Bureau of Labor Statistics.

NATIONAL SAFETY COMPETITION

The national safety competitions sponsored and conducted annually by the Bureau of Mines stimulated great interest among the Nation's mineral-extracting industries. By according national recognition to operations achieving outstanding safety records, these competitions encouraged development of more effective accident-prevention programs. Of the 1,550 operations participating in the 1962 competitions, 768 (50 percent) were injury-free. These 768 injury-free operations worked more than 41 million man-hours (24 percent) of the total exposure to occupational hazards.

Of the five competitions conducted by the Bureau of Mines, two were sponsored solely by the Bureau. They were the National Safety and the National Sand and Gravel Competitions. In these two contests, 615 operations (51 percent) finished the 1962 competition year free of disabling work injuries. These 615 accounted for 30,746,779 man-hours (21 percent) of the total man-hours worked (143,319,047) by all the participating operations.

The Bureau of Mines also conducted three other annual competitions, cosponsored by national associations connected with the mineral industries—the National Crushed Stone Association, National Lime Association, and National Slag Association. During 1962, 335 plants participated in the association-sponsored contests, of which 153 (46 percent) attained injury-free records during an aggregate worktime of more than 10 million man-hours. These injury-free man-hours accounted for 34 percent of the total man-hours worked by all plants participating in these competitions.

Trophy awards for the best safety records in each of the six groups in the 1962 National Safety Competition were made to the following companies:

Anthracite Underground Mines.—Penag mine of Penag Coal Company, Good Springs, Pa.

Bituminous Coal Underground Mines.—Maple Creek mine of United States Steel Corp., New Eagle, Pa.

Metal Underground Mines.—Deremo mine of Union Carbide Nuclear Co., Dove Creek, Colo.

Nonmetal Underground Mines.—Bellefonte mine of National Gypsum Co., Bellefonte, Pa.

Open-Pit Mines.—Sherman Mine of Oliver Iron Mining Division, United States Steel Corp., Chisholm, Minn.

Quarries.—Calcite quarry of Michigan Limestone Division, United States Steel Corp., Rogers City, Mich.

TABLE 3.—Employment and injury experience in the mineral industries

Year	Men working	Man-hours worked	Number of injuries		Injury rate per million man-hours	
			Fatal	Nonfatal	Fatal	Nonfatal
1931	784,347	1,288,135,808	1,707	94,021	1.33	72.99
1932	671,343	962,924,915	1,368	66,028	1.42	68.57
1933	677,722	1,058,245,650	1,242	70,158	1.17	66.30
1934	739,817	1,167,723,543	1,429	79,211	1.22	67.83
1935	783,139	1,215,316,764	1,495	80,070	1.23	65.88
1936	824,514	1,426,233,543	1,686	90,608	1.18	63.53
1937	859,951	1,482,241,908	1,759	94,466	1.19	63.73
1938	774,894	1,144,137,296	1,369	69,940	1.20	61.13
1939	788,925	1,251,169.210	1,334	73,253	1.07	58.55
1940	801,926	1,385,128,234	1,716	80,856	1.24	58.37
1941	835,095	1,541,335,277	1,621	87,911	1.05	57.04
1942 [1]	1,120,450	2,319,213,897	1,970	100,861	.85	43.49
1943	1,144.831	2,555.619,729	1,953	101,164	.76	39.58
1944	1,086.103	2,573,452,816	1,751	98,066	.68	38.11
1945	1,033,035	2,363,783,323	1,414	87,578	.60	37.05
1946	1,108,517	2,275,960,528	1,336	86,291	.59	37.91
1947	1,179,835	2,469,256,565	1,556	91,311	.63	36.98
1948	1,242,241	2,530,418,226	1,383	86,295	.55	34.10
1949	1,240,330	2,256,418,166	898	65,909	.40	29.21
1950	1,237,649	2,340,954,733	952	66,729	.41	28.51
1951	1,223,639	2,418,090,394	1,122	67,285	.46	27.83
1952	1,230,692	2,383,608,034	927	61,296	.39	25.72
1953	1,193,182	2.357,970,591	817	53,992	.35	22.90
1954	1,096,423	2,138,687,112	671	43,130	.31	20.17
1955 [2]	1,122,393	2,290,057,680	729	46,197	.32	20.17
1956 [3]	1,113,471	2,294,678,414	788	45,454	.34	19.81
1957 [4]	1,187,052	2,409,969,589	810	45,898	.34	19.05
1958 [5]	1,129,638	2,208,298,487	656	39,925	.30	18.08
1959	1,106,534	2,194,901,514	597	37,750	.27	17.20
1960	1,045,111	2,082,521,189	603	36,044	.29	17.31
1961	951,378	1,913,481,071	542	34,173	.28	17.86
1962 [6]	908,783	1,837,610,177	643	31,985	.35	17.41

[1] Includes oil and gas beginning with 1942.
[2] Clay mines and nonmetal mills included beginning with 1955.
[3] Clay mills included beginning with 1956.
[4] Peat and sand and gravel included beginning with 1957.
[5] Slag included beginning with 1958.
[6] Preliminary figures.

The Mineral Industry of Alabama

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Alabama for collecting information on all minerals except fuels.

By Avery H. Reed, Jr.[1] and Thomas A. Simpson[2]

RECORD production of marble, kaolin, scrap mica, and talc highlighted the mineral industry of Alabama in 1962. Among the States, Alabama ranked second in scrap mica, third in the production of bauxite and native asphalt, and fifth in iron ore.

The mineral industry of Alabama was dominated by mining and processing of coal and iron ore, and the manufacture of cement, which together comprised 73 percent of the total value of production, compared with 72 percent in 1961. Other important industries were the production of crude petroleum, and stone quarrying. Leading companies were Tennessee Coal & Iron, Southern Cement Co., Southeastern Electric Generating Co., Alabama By-Products Corp., and U.S. Pipe & Foundry Co.

The total value of mineral production was about the same as in 1961 and was the highest recorded. There were substantial decreases in the values for iron ore. Tennessee Coal & Iron closed its red iron ore mines on Red Mountain.

Trends and Developments.—Tennessee Coal & Iron (TCI) abandoned its red ore mining operations in the Birmingham district. Republic Steel Corp. and U.S. Pipe & Foundry Co. had abandoned red iron ore mining in previous years. Woodward Iron Co. remained the only industrial organization which continued to mine and use the red ores that abound in Red Mountain near Birmingham. TCI imported rich iron ores from Venezuela, and Republic Steel imported iron ore from Liberia. The imported iron ores averaged 64 percent iron, whereas the local red iron ores averaged 37 percent iron.

Alabama Power Co. announced the planning of a large steam generating plant in west central Alabama, located on the Warrior River 14 miles upstream from Demopolis.

Construction of the Miller's Ferry Lock and Dam on the Alabama River was planned to begin early in 1963. The dam, which would

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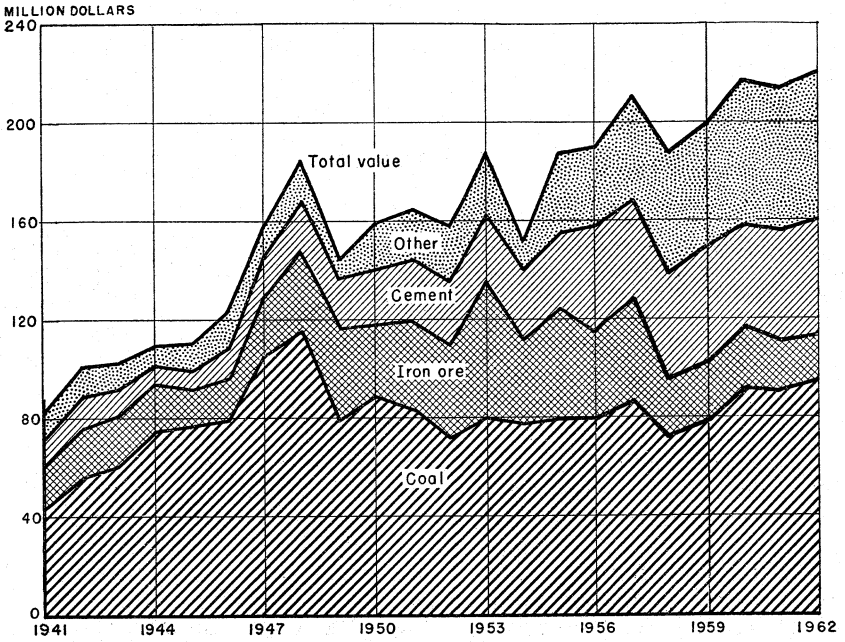

FIGURE 1.—Value of coal, iron ore, cement, and total value of mineral production in Alabama, 1941–62.

be located in Wilcox County, about 10 miles northwest of Camden, was estimated to cost $53 million.

Alabama Power Co. awarded a contract for the construction of a new $90 million steam electric generating plant in Greene County. Sixty percent of the plant would be owned by Alabama Power Co. and 40 percent by Mississippi Power Co. The capacity of the plant would be 500,000 kilowatts.

Legislation and Government Programs.—The Bureau of Mines operated the Tuscaloosa Metallurgy Research Center at Tuscaloosa, working on a wide range of research problems in the mineral industries. The University of Alabama formally dedicated its new mineral industries building on the campus at Tuscaloosa.

Employment and Injuries.—The Bureau of Mines received reports of 99 percent of the total employment in the mineral industries, excluding coal mines and the oil and gas industry, under Public Law 87–300. These figures would serve as bench marks for employment and injuries in future years. During 1962, there was a general decline in employment in all industries. The greatest decrease in man-hours worked was in metal mines which declined 42 percent because of the closing of the TCI red iron ore mines. Although the number of operations remained about the same, the number of men working daily decreased by 2,855, or 17 percent. Total employment decreased 21 percent.

The injury-frequency rate remained about the same—11 fatalities compared with 10 in 1961.

TABLE 1.—Mineral production in Alabama [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Masonry thousand 280-pound barrels	2,006	$6,156	2,187	$6,521
Portland thousand 376-pound barrels	12,445	39,027	12,482	40,164
Clays [2] thousand short tons	1,787	2,068	1,632	1,947
Coal (bituminous) do	12,915	90,903	12,880	95,149
Iron ore (usable) thousand long tons, gross weight	3,597	20,510	2,962	17,838
Lime thousand short tons	579	6,871	522	6,298
Natural gas million cubic feet	56	4	128	13
Petroleum (crude) thousand 42-gallon barrels	6,931	19,060	[3] 7,493	[3] 19,407
Sand and gravel thousand short tons	5,800	6,452	4,655	4,486
Stone [4] do	13,651	19,909	12,680	19,667
Value of items that cannot be disclosed: Asphalt (native), bauxite, slag cement, clay (kaolin), mica, salt, stone (dimension limestone and marble, oystershell, and crushed sandstone), and talc		7,919		8,347
Total		[5] 218,879		219,837

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes kaolin; included with "Value of items that cannot be disclosed."
[3] Preliminary figure.
[4] Excludes certain stone; included with "Value of items that cannot be disclosed."
[5] Revised figure.

TABLE 2.—Employment and injuries in the mineral industries

Year and industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:							
Coal mines	201	6,761	196	10,524,338	10	147	15
Quarries and mills	56	2,967	274	6,638,264		78	12
Coke ovens and smelters	8	2,522	365	7,507,965		53	7
Metal mines	38	2,656	233	5,007,813		27	5
Nonmetal mines	34	996	243	1,948,246		57	29
Sand and gravel mines	43	654	255	1,406,908		40	28
Total	380	16,556	247	33,033,534	10	402	12
1962: [1]							
Coal mines	200	6,039	194	9,358,492	7	100	11
Quarries and mills	53	2,511	273	5,722,411		76	13
Coke ovens and smelters	9	1,909	343	5,304,402		24	5
Metal mines	34	1,820	191	2,915,044	2	34	12
Nonmetal mines	36	942	251	1,682,565		38	23
Sand and gravel mines	35	480	245	983,752	2	29	32
Total	367	13,701	236	25,966,666	11	301	12

[1] Preliminary figures.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Asphalt (Native).—Alabama Asphaltic Limestone Co. (Margerum quarry) crushed bituminous limestone in Colbert County for roadstone; production decreased by 25 percent. Alabama ranked third among the States in the production of native asphalt.

Coal (Bituminous).—Bituminous coal was mined at 186 mines in 10 counties, compared with 193 mines in 10 counties in 1961. The leading counties were Jefferson, Walker, and Tuscaloosa. The leading

companies were Tennessee Coal & Iron, Southeastern Electric Generating Co., Alabama By-Products Corp., Woodward Iron Co., and U.S. Pipe & Foundry Co., which together supplied 57 percent of the State total. Production was about the same as in 1960 and was 39 percent below the 1926 record. Average output per mine increased from 66,900 tons in 1961 to 69,200 tons.

Underground mines produced 77 percent of the production, strip mines 22 percent, and auger mines 1 percent. Ninety percent of the coal was shipped by rail or water, 4 percent by conveyor belt, and 6 percent by truck. Coal was loaded by 101 mobile loading machines, which loaded 87 percent of the underground production; 3 continuous mining machines loaded 3 percent; 4 self-loading conveyors and 45 face conveyors loaded 3 percent; 93 percent of the coal mined underground was mechanically loaded. Captive tonnage was 59 percent of the total, compared with 58 percent in 1961.

Equipment used at 140 underground mines included 178 cutting machines, which cut 98 percent of the tonnage; 245 power drills, which drilled 96 percent; 234 locomotives; 26 tractors; 213 shuttle cars; and 62 mother conveyors.

Equipment used at 42 strip mines included 69 power shovels, 19 draglines, 5 carryall scrapers, 65 bulldozers, 28 power drills, and 95 trucks. An estimated 40 million cubic yards of overburden was excavated.

Four coal-recovery augers and seven trucks were used at four auger mines.

Of the total production of coal, 86 percent was cleaned at 33 cleaning plants.

Coke.—Six companies produced byproduct metallurgical coke at seven plants in Jefferson, Etowah, and Tuscaloosa Counties. Leading coke producers were Tennessee Coal & Iron and U.S. Pipe & Foundry Co.

Natural Gas.—Marketed production of natural gas from Marion County remained about the same as in 1961.

TABLE 3.—Coal (bituminous) production, by counties

County	1961		1962	
	Short tons	Value (thousand)	Short tons	Value (thousand)
Bibb	40,607	$152	43,211	$224
Blount	160,976	841	(1)	(1)
Cullman	31,132	187	9,850	58
Jackson	16,375	98	15,050	104
Jefferson	6,946,256	52,738	6,811,551	53,438
Marion	181,726	821	243,820	977
Shelby	420,942	3,318	533,735	4,634
Tuscaloosa	(1)	(1)	693,131	3,258
Walker	(1)	(1)	4,270,518	31,198
Winston	108,268	[2] 487	(1)	(1)
Undistributed	5,009,183	32,261	258,794	1,258
Total	12,915,465	90,903	12,879,660	95,149
Earliest record to date	972,560,000	(3)	985,440,000	(3)

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Revised figure.
[3] Data not available.

Petroleum.—Production of crude petroleum increased 8 percent to 2 percent above the 1960 record. Leading counties were Mobile and Escambia. During 1962, 18 new producing wells were drilled. The 444 producing wells were in the following counties: Baldwin, 6; Choctaw, 51; Clarke, 14; Escambia, 21; and Mobile, 352. During the year, 40 wells totaling 382,000 feet were drilled.

TABLE 4.—Crude petroleum production, by counties

(Barrels)

County	1961	1962[1]
Baldwin	31,156	40,459
Choctaw	267,956	268,555
Clarke	130,011	132,906
Escambia	629,061	574,021
Mobile	5,872,816	6,477,059
Total	6,931,000	7,493,000
Earliest record to date	40,730,000	48,223,000

[1] Preliminary figures.

Source: State Oil & Gas Board.

NONMETALS

Cement.—Eight companies produced masonry cement at nine plants in five counties. Major producers were Southern Cement Co. and Universal Atlas Cement. Shipments increased 9 percent, but were 16 percent below the 1955 record. Consumption of masonry cement in Alabama was 24 percent of the shipments. Out-of-State shipments were made to Georgia (33 percent), South Carolina (10 percent), Florida (8 percent), Mississippi (7 percent), North Carolina (6 percent), Louisiana (6 percent), Tennessee (4 percent), and other States (2 percent).

Seven companies produced portland cement at eight plants in five counties. Principal producers were Ideal Cement Co. (Mobile plant) and Southern Cement Co. (Calera plant). Shipments were about the same as in 1961 and were 4 percent below the 1959 record. Consumption of portland cement in Alabama was 37 percent of shipments. Out-of-State shipments were made to Georgia (21 percent), Florida (14 percent), Mississippi (11 percent), South Carolina (7 percent), Louisiana (4 percent), Tennessee (3 percent), and other States (3 percent). The raw materials used in manufacturing portland cement included limestone and oystershell (59 percent), cement rock (21 percent), clay and shale (12 percent), and other materials (8 percent).

The end uses of portland cement were as follows: Ready-mixed concrete (52 percent), concrete-products manufacturers (19 percent), highway contractors (12 percent), building materials dealers (9 percent), and other uses (8 percent). Annual capacity of portland cement plants was 16.3 million barrels.

Southern Cement Co. and Cheney Lime & Cement Co. produced slag cement. Shipments increased 22 percent but were 73 percent below the 1952 record.

During 1962 Woodward Iron Co. purchased National Cement Co. Ideal Cement Co. completed a $1.5 million improvement project at the Mobile plant.

Clays.—Twenty-one companies mined 1,409,000 tons of miscellaneous clay at 22 mines in 12 counties for use in portland cement and heavy clay products. Leading producers were Southern Cement Co. and Jenkins Brick Co. Production decreased 7 percent and was 9 percent below the 1960 record.

Thirteen companies mined fire clay at 14 mines in 6 counties. The main producers were Donoho Clay Co. and Natco Corp. Production decreased 18 percent and was 27 percent below the 1956 record.

Harbison-Walker Refractories Co. and Thomas Alabama Kaolin Co. mined kaolin in Henry and Marion Counties. Production increased 29 percent above the 1961 record.

TABLE 5.—Fire clay sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Foundries and steelworks	26,154	$68,850	$2.63	134,245	$441,812	$3.29
Firebrick and block	91,825	241,217	2.63	19,989	51,200	2.56
Fire-clay mortar	7,271	14,184	1.95	6,665	33,349	5.01
Other [1]	145,063	375,712	2.59	61,747	157,344	2.55
Total	270,313	699,963	2.59	222,646	683,705	3.07

[1] Includes kiln furniture (1961), heavy clay products, and bauxite, high-alumina brick.

Lime.—Seven companies produced quicklime and hydrated lime at eight plants in Shelby, Dallas, and Jefferson Counties for building, agricultural, refractory, chemical, and industrial uses. Leading producers were Southern Cement Co. (Roberta and Keystone limekilns) and Longview Lime Corp. Production decreased 10 percent below the 1961 record. Consumption of lime in Alabama amounted to 56 percent of shipments. Out-of-State shipments were made to Florida (15 percent), Georgia (12 percent), Mississippi (6 percent), Tennessee (5 percent), Louisiana (2 percent), exports (2 percent), and other States (2 percent).

Six companies recovered quicklime at seven papermills in Choctaw, Escambia, Marengo, Mobile, Talladega, and Tuscaloosa Counties. The leading producers of regenerated lime were International Paper Co. and Scott Paper Co., operating in Mobile County.

Magnesium Compounds.—Tennessee Coal & Iron produced dead-burned dolomite for refractory use.

Mica.—Dixie Mines, Inc., mined scrap mica at the Dixie mine and produced 1 percent more than in 1961. Dixie Mines, Inc., also mined a small quantity of sheet mica. Alabama ranked second among the States in the production of scrap mica. Part of the scrap mica was ground at Heflin and the remainder was shipped to Texas for grinding.

TABLE 6.—Lime sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Chemical and industrial	478,659	$5,496,500	$11.48	412,917	$4,837,820	$11.72
Other [1]	100,652	1,374,059	13.65	108,719	1,460,570	13.43
Total	579,311	6,870,559	11.86	521,636	6,298,390	12.07

[1] Includes construction, agriculture, and refractory lime.

Salt.—Olin Mathieson Chemical Corp. produced salt from brine in Washington County. Production decreased 4 percent and was 12 percent below the 1960 record.

Sand and Gravel.—Thirty-three companies mined sand and gravel at 35 mines in 24 counties. The leading counties were Montgomery, Mobile, and Elmore. The major producers were Alabama Gravel Co. (Elmore and Montgomery Counties), Radcliff Materials, Inc. (Mobile County), Southeastern Sand & Gravel Inc. (Chilton and Montgomery Counties), Birmingham Slag (Montgomery County), and Dallas Sand & Gravel Co. Inc. (Autauga County). Production declined 20 percent below the 1961 record. Virtually the entire production was processed. Forty-six percent was shipped by truck, 42 percent by rail, and 12 percent by water.

TABLE 7.—Sand and gravel sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Autauga	210,000	$207,850	(1)	(1)
Baldwin			16,212	$30,967
Barbour	21,043	29,567	13,446	25,114
Calhoun	283,544	253,504	(1)	(1)
Cherokee	1,798	4,292	1,881	4,461
Conecuh	75,309	86,057	55,220	55,580
Dallas	148,000	182,300	160,596	160,596
Jefferson	89,537	100,159	(1)	(1)
Mobile	513,316	911,466	499,171	499,171
Monroe	(1)	(1)	36,400	32,000
Montgomery	1,462,314	1,611,327	1,588,061	1,320,612
St. Clair	605	1,361		
Talladega	16,058	25,049	(1)	(1)
Undistributed [2]	2,978,420	3,038,990	2,283,619	2,359,185
Total	5,799,944	6,451,922	4,654,606	4,485,686

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes the following additional counties for which figures are withheld to avoid disclosing individual confidential data: Chilton, Clarke (1962), Dale (1962), Elmore, Escambia, Franklin, Greene (1962), Houston, Macon, Morgan, Russell, Tuscaloosa.

TABLE 8.—Sand and gravel sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	1,611,600	$1,393,780	$0.86	1,212,956	$959,626	$0.79
Paving	605,949	488,130	.81	563,485	427,346	.76
Engine				98,786	98,759	1.00
Molding	85,626	200,230	2.34	(1)	(1)	(1)
Fill	13,573	6,349	.47	45,510	27,172	.60
Railroad ballast	36,314	22,657	.62	(1)	(1)	(1)
Filtration	20,000	13,000	.65	(1)	(1)	(1)
Gravel:						
Paving	1,450,966	1,655,079	1.14	1,407,165	1,353,833	.96
Structural	1,803,641	2,470,210	1.37	845,609	952,913	1.13
Fill	(1)	(1)	(1)	24,990	29,112	1.16
Railroad ballast	54,250	51,787	.95	(1)	(1)	(1)
Other sand and gravel	118,025	150,700	1.28	456,105	636,925	1.40
Total	5,799,944	6,451,922	1.11	4,654,606	4,485,686	.96

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other sand and gravel."

Stone.—Thirty-four companies crushed limestone at 39 quarries in 17 counties. The principal producing counties were Shelby, Jefferson, Madison, and Colbert. The leading producers were Lone Star Cement Corp., Birmingham Slag Co., Madison Limestone Co., and Southern Cement Co. Production decreased 8 percent below the 1961 record. Of the total production, 59 percent was shipped by truck, 28 percent by rail, 7 percent by conveyor belt, and 6 percent by water.

Alabama Limestone Co. quarried dimension limestone in Franklin County for rubble, rough architectural stone, and dressed building stone. Production declined 27 percent to 56 percent below the 1956 record.

Thompson-Weinman & Co., Moretti-Harrah Marble Co., and Alabama Marble Co. crushed marble in Sylacauga for whiting, terrazzo, and other uses. Production increased 20 percent and was 13 percent above the 1960 record.

Moretti-Harrah Marble Co. and Alabama Marble Co. quarried dimension marble at Sylacauga for rough and dressed building stone and for dressed monumental stone. Production increased 13 percent above the 1961 record.

Radcliff Materials, Inc., and Southern Oystershell Milling Corp. crushed Mobile Bay oystershell for cement, concrete and roads, and poultry grit. Although production increased 53 percent, it remained 26 percent below the 1957 record.

Universal Atlas Cement Co. and Sam P. Acton crushed sandstone for cement and refractories. Production increased 9 percent but was 89 percent below the 1956 record.

A. O. Brown quarried dimension sandstone for rough architectural building stone in Blount County. Output increased 8 percent but was 88 percent below the 1954 record.

TABLE 9.—Crushed limestone sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Colbert	1,200,735	$1,361,057	1,145,529	$1,332,122
Henry	16,840	33,680	16,840	62,000
Jefferson	3,494,818	3,922,966	2,979,469	3,393,744
Limestone	61,826	92,739	52,663	78,949
Shelby	3,770,724	5,505,763	3,470,376	4,850,971
Undistributed [1]	4,809,222	5,084,099	4,660,308	5,004,821
Total	13,354,165	16,000,304	12,325,185	14,722,607

[1] Includes the following counties for which figures are withheld to avoid disclosing individual company confidential data: Conecuh, Covington, De Kalb, Etowah, Franklin, Jackson (1961), Madison, Marengo, Marshall, Morgan, St. Clair, Talladega, and Washington.

TABLE 10.—Crushed limestone sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roads	6,495,775	$8,324,452	$1.28	5,709,150	$7,175,181	$1.26
Cement manufacture	3,548,278	2,483,416	.70	3,471,156	2,476,977	.71
Fluxing stone	1,269,291	2,047,720	1.61	979,585	1,606,443	1.64
Lime manufacture	772,190	965,200	1.25	888,879	1,170,011	1.32
Agstone	672,271	1,085,552	1.61	591,626	986,669	1.67
Riprap	(1)	(1)	(1)	196,647	233,172	1.19
Rockdust for coal mines	(1)	(1)	(1)	62,401	255,380	4.09
Paper	26,807	63,495	2.37	30,603	72,686	2.38
Asphalt filler	50,000	200,000	4.00	(1)	(1)	(1)
Other uses [2]	519,553	830,469	1.60	395,138	746,088	1.89
Total	13,354,165	16,000,304	1.20	12,325,185	14,722,607	1.19

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses".
[2] Includes refractory stone, railroad ballast, alkali, whiting, mineral food, stone sand, other uses, and uses indicated by footnote 1.

Talc.—American Talc Co. mined and ground talc at Winterboro for paint and toilet preparations. Production increased 3 percent above the 1961 record.

Vermiculite.—Zonolite Co. exfoliated vermiculite at its Birmingham plant, using crude materials from out-of-State.

METALS

Aluminum.—Reynolds Metals Co. operated the Listerhill aluminum reduction plant at Sheffield.

Bauxite.—Harbison-Walker Refractories Co., R. E. Wilson Mining Co., and Wilson-Sneed Bauxite Co. mined crude bauxite in Barbour and Henry Counties for refractories and chemicals. Production increased 44 percent. Alabama ranked third among the States in the production of bauxite. Harbison-Walker Refractories Co. completed a new rotary-kiln plant at Eufaula for calcining bauxite and clay.

Iron Ore.—Total shipments of iron ore declined 18 percent and were 67 percent below the 1942 record. Shipments were the lowest since

1934. Of the total shipments, 31 percent was direct-shipping ore, compared with 44 percent in 1961 and 52 percent in 1960. The number of operating mines decreased from 30 to 27, and the average usable output per mine decreased from 120,000 to 110,000 tons. Among the States, Alabama was fifth in iron ore production.

Tennessee Coal & Iron, Woodward Iron Co., and Southeastern Coal & Iron Co. mined red iron ore (hematite) at three mines in Jefferson and Tuscaloosa Counties. Production declined 29 percent and was 76 percent below the 1942 record. During 1962, Tennessee Coal & Iron abandoned all red iron ore mining in the Birmingham area. Woodward Iron Co. purchased the Southeastern Coal & Iron Co. and continued as the only producer of red iron ore from the Birmingham district.

Twenty operators mined brown iron ore (limonite) for pig iron at 23 mines in 11 counties. The leading counties were Butler, Franklin, and Pike. The principal producers were Shook & Fletcher Supply Co. (Blount and Franklin Counties), Glenwood Mining Co. Inc., (Butler and Pike Counties), and U.S. Pipe & Foundry Co. (Franklin County). Production increased 44 percent but remained 42 percent below the 1942 record.

The Geological Survey of Alabama investigated the occurrences of brown iron ore in Barber, Butler, Crenshaw, and Pike Counties by drilling holes with a bucket drill.

TABLE 11.—Usable iron ore production and shipments

	1961		1962	
	Long tons	Iron content, natural (percent)	Long tons	Iron content, natural (percent)
Production:				
Hematite	2,583,469	36	1,825,110	37
Limonite	799,683	47	1,152,816	47
Shipments:				
Direct shipping ore	[1] 1,594,509	36	917,795	37
Concentrates and sinter	[1] 2,002,293	47	2,044,213	47

[1] Revised figure.

Magnesium.—Alabama Metallurgical Corp. manufactured magnesium from dolomite at Selma. Calumet & Hecla purchased all the stock of Alabama Metallurgical Corp.

Pig Iron and Steel.—Tennessee Coal & Iron, Republic Steel Corp., Woodward Iron Co., and U.S. Pipe & Foundry Co. produced 3,628,000 tons of basic, foundry, and malleable pig iron, compared with 3,531,000 tons in 1961. Value of shipments was $206,565,000, compared with $202,946,000 in 1961. Iron ore consumed in blast furnaces, agglomerating plants, and steel mills was 62 percent domestic and 38 percent imported. Imports of iron ore, chiefly from Venezuela, Liberia, Chili, and Peru, increased 49 percent but were 33 percent below the 1959 record. Tennessee Coal & Iron announced plans to construct a multimillion dollar tin mill at Fairfield. Republic Steel Corp. announced plans for the construction of six basic oxygen steelmaking furnaces costing $100 million at three plants, including one at Gadsden.

TABLE 12.—Usable iron ore shipments, by counties

County	1961		1962	
	Long tons	Value	Long tons	Value
Barbour	53, 999	$251, 600	(1)	(1)
Butler	158, 734	913, 320	366, 540	$1, 941, 130
Pike	256, 807	1, 175, 100	291, 433	1, 396, 625
Undistributed [2]	3, 127, 262	18, 170, 332	2, 304, 035	14, 500, 551
Total	3, 596, 802	20, 510, 352	2, 962, 008	17, 838, 306

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes the following counties for which figures are withheld to avoid disclosing individual company confidential data: Blount, Calhoun, Crenshaw, Franklin, Jefferson, Shelby, Talladega, and Tuscaloosa.

TABLE 13.—Mine production and shipments of crude iron ore

	1961		1962	
	Number of mines	Long tons	Number of mines	Long tons
Mine production:				
By varieties:				
Hematite	3	2, 688, 269	3	1, 965, 613
Limonite	27	2, 867, 627	24	4, 559, 300
By mining methods:				
Open pit	28	2, 878, 053	25	4, 619, 948
Underground	2	2, 677, 843	2	1, 904, 965
Shipments from mines:				
Direct to consumers	4	1, 594, 509	3	917, 795
To beneficiation plants	27	4, 052, 356	26	5, 609, 786

REVIEW BY COUNTIES

Mineral production was reported from 48 of the 67 counties, compared with 46 in 1961. The major producing counties were Jefferson, Mobile, Walker, and Shelby, which together furnished 81 percent of the total State value.

Autauga.—Dallas Sand & Gravel Co., Inc., mined building, paving, and fill sand, and fluxing gravel.

Baldwin.—Output of crude petroleum from six oil wells was 30 percent more than in 1961. Hinote Sand Supply mined building gravel at Robertsdale. Fairhope Clay Products Co. mined miscellaneous clay for heavy clay products.

Barbour.—R. E. Wilson Mining Co. and Wilson-Sneed Mining Co. mined bauxite for chemicals and refractories. H. D. Loflin and B. & C. Construction Co. mined brown iron ore for pig iron. McKenzie Construction Co. mined building and paving sand and paving gravel.

Bibb.—Seven coal mines were active, and the leading producers were Fitts & Gay Coal Co. (No. 1 strip mine) and Bibb Mining Co. (Bibb No. 1 strip mine).

Blount.—Four coal mines were active, the leading producers being Robins Coal Co., Inc. (Southview strip mine), and Camp Coal Co. (No. 1 strip mine). Shook & Fletcher Supply Co. mined brown iron ore at the Champion mine. Cheney Lime & Cement Co. produced masonry and slag cements at the Graystone mill. Harbison-Walker

Refractories Co. (Thermal mine) and Lehigh Coal Co. (Lehigh mine) mined fire clay for refractories. A. O. Brown quarried a small quantity of dimension sandstone for rough architectural use.

TABLE 14.—Value of mineral production in Alabama, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value
Autauga	$207,850	(2)	Sand and gravel.
Baldwin	(2)	(2)	Petroleum, sand and gravel, miscellaneous clay.
Barbour	(2)	(2)	Bauxite, iron ore, sand and gravel.
Bibb	151,936	$223,699	Coal.
Blount	1,278,774	1,294,074	Coal, iron ore, cement, fire clay, sandstone.
Butler	913,320	1,941,130	Iron ore.
Calhoun	(2)	(2)	Fire clay, iron ore, sand and gravel, miscellaneous clay.
Cherokee	4,292	4,461	Sand and gravel.
Chilton	(2)	(2)	Sand and gravel, miscellaneous clay.
Choctaw	(2)	(2)	Petroleum.
Clarke	(2)	(2)	Petroleum, sand and gravel.
Colbert	(2)	(2)	Limestone, native asphalt.
Conecuh	(2)	(2)	Sand and gravel, limestone.
Covington	(2)	(2)	Limestone.
Crenshaw	(2)	(2)	Iron ore.
Cullman	186,957	58,346	Coal.
Dale	(2)	(2)	Sand and gravel.
Dallas	(2)	(2)	Lime, sand and gravel.
DeKalb	(2)	(2)	Limestone.
Elmore	(2)	(2)	Sand and gravel, miscellaneous clay.
Escambia	(2)	(2)	Petroleum, sand and gravel, miscellaneous clay.
Etowah	(2)	(2)	Limestone.
Franklin	3,023,514	2,617,952	Iron ore, limestone, sand and gravel, fire clay.
Greene	----------	(2)	Sand and gravel.
Henry	(2)	(2)	Kaolin, bauxite, limestone.
Houston	(2)	(2)	Sand and gravel.
Jackson	(2)	104,447	Coal.
Jefferson	96,722,493	93,438,474	Coal, cement, iron ore, limestone, lime, miscellaneous clay, sandstone, fire clay, magnesium compounds, sand and gravel.
Limestone	92,739	78,949	Limestone.
Macon	(2)	(2)	Sand and gravel.
Madison	(2)	(2)	Limestone, miscellaneous clay.
Marengo	(2)	(2)	Cement, limestone.
Marion	(2)	(2)	Coal, kaolin.
Marshall	(2)	(2)	Limestone.
Mobile	(2)	(2)	Petroleum, cement, oystershell, sand and gravel, miscellaneous clay.
Monroe	(2)	32,000	Sand and gravel.
Montgomery	(2)	(2)	Sand and gravel, miscellaneous clay.
Morgan	(2)	(2)	Limestone, sand and gravel.
Pike	1,175,100	1,396,625	Iron ore.
Randolph	(2)	(2)	Mica.
Russell	(2)	(2)	Miscellaneous clay, sand and gravel.
St. Clair	(2)	(2)	Cement, limestone, miscellaneous clay, fire clay.
Shelby	22,511,965	22,958,935	Cement, lime, limestone, coal, miscellaneous clay, iron ore.
Talladega	(2)	(2)	Marble, limestone, iron ore, sand and gravel, talc.
Tuscaloosa	3,885,211	(2)	Coal, iron ore, sand and gravel.
Walker	(2)	(2)	Coal, fire clay.
Washington	(2)	(2)	Limestone, salt.
Winston	487,206	(2)	Coal.
Undistributed	[3] 88,237,643	95,687,908	
Total	[3] 218,879,000	219,837,000	

[1] The following counties are not listed because no production was reported: Bullock, Chambers, Clay, Cleburne, Coffee, Coosa, Fayette, Geneva, Hale, Lamar, Lauderdale, Lawrence, Lee, Lowndes, Perry, Pickens, Tallapoosa, Sumter, and Wilcox.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.

Butler.—Six companies mined brown iron ore for pig iron, the leading producers were Woodward-Acree Mining Co. and Pigeon Creek Mining Co.

Calhoun.—Donoho Clay Co. and Dixie Clay Co. mined fire clay. Fred Brown Mining Co. and Oak Mining Co. mined brown iron ore for pig iron. Wade and Vance Sand & Gravel Co. Inc., mined build-

ing sand and gravel at Ohatchee. Agricola Brick Co. mined miscellaneous clay for heavy clay products.

Cherokee.—A small quantity of molding sand was mined by Wolf Creek Sand Co.

Chilton.—Southeastern Sand & Gravel Co., Inc., mined building, paving, filtration, and railroad ballast sand, and building, paving, and railroad ballast gravel. Norman E. Smith mined a small quantity of miscellaneous clay.

Choctaw.—Crude petroleum production from 51 wells was about the same as in 1961. Two new wells totaling 11,000 feet were drilled during 1962. Marathon Southern Corp. produced regenerated lime at its paper plant.

Clarke.—Crude petroleum production from 14 wells was about the same as in 1961. Three new wells totaling 12,000 feet were drilled. Jackson Sand & Gravel Co. and Paul Sand & Gravel Co. mined structural sand and gravel.

Colbert.—Tri-States Limestone, Inc., Ralph Rogers & Co., Inc., and Alabama Asphaltic Limestone Co. crushed limestone for concrete and roads, agstone, riprap, railroad ballast, and stone sand. Alabama Asphaltic Limestone Co. (Margerum quarry) mined native asphalt for roadstone.

Conecuh.—Castleberry Gravel Co. mined building sand and gravel. Conecuh Lime Co., Inc., mined limestone for agricultural uses.

Covington.—Miller Lime Pit crushed limestone for roadstone and agricultural stone (agstone).

Crenshaw.—Brown iron ore for pig iron was mined by McGhee & Merrill Co.

Cullman.—Trimble Coal Co. (No. 3 mine) and H. E. Drummond Coal Co. Inc. (Drummond Strip mine), mined bituminous coal.

Dale.—Speigner Concrete Block Co. produced building and fill sand.

Dallas.—Alabama Metallurgical Corp. operated the Selma plant and produced magnesium metal and dolomitic lime. C. Pierson Cosby mined building sand, molding sand, engine sand, and miscellaneous gravel.

DeKalb.—Peersall Limestone, Inc., produced crushed limestone for roadstone and agstone at Fort Payne.

Elmore.—Alabama Gravel Co. mined building sand and gravel and Jenkins Brick Co. mined miscellaneous clay for heavy clay products.

Escambia.—Crude petroleum production from 21 oil wells decreased 9 percent. During 1962 one new well was drilled to a depth of 6,000 feet. Dixie Sand & Gravel Co. and Flomaton Gravel Co., Inc., mined building, paving, and fill sand and gravel. Keego Clay Products Co. mined miscellaneous clay for heavy clay products. Container Corp. of America regenerated lime at its papermill.

Etowah.—Republic Steel Corp. produced pig iron and steel at the Gadsden plant. Alabama Aggregate and Birmingham Slag crushed limestone for riprap, roadstone, agstone, and fluxing stone.

Franklin.—Four operators produced brown iron ore for pig iron, the leading producers were U.S. Pipe & Foundry Co. (Russellville No. 15 mine) and Shook & Fletcher Supply Co. (Blackburn mine). Alabama Limestone produced dimension limestone at the Rockwood and Aday mine for rubble, rough architectural, veneer, sawed and dressed or cut and dressed building stone, and curbing and flagging.

Clark & Ford, Inc. (Isbell quarry) and Alabama Limestone crushed limestone for roadstone, agstone, paint filler, asphalt filler, roofing, and mineral food. Tennessee Valley Sand & Gravel Co. mined building and paving sand and gravel at the Spruce Pine mine. The company also mined fire clay for refractories.

Greene.—Akron Sand Co. produced building sand at Gainesville.

Henry.—Harbison-Walker Refractories Co. mined refractory kaolin. Also Harbison-Walker Refractories Co. and Wilson-Sneed Mining Co. mined bauxite for refractories. Abbeville Lime Co. crushed limestone for agstone.

Houston.—L. C. Smith Sand & Gravel Co. produced building sand and gravel at Dothan.

Jackson.—Reams & Smith Coal Co. (No. 1 mine) and Claude Cain Coal Co. (Fork Mountain mine) mined bituminous coal.

Jefferson.—Seventy coal mines were active, and the leading mines were the Maxine mine (Alabama By-Products Corp.), the Concord No. 1 mine (Tennessee Coal & Iron), and the Mulga mine (Woodward Iron Co.).

Southern Cement Co. produced masonry and slag cement at the North Birmingham mill. Universal Atlas Cement (Leeds mill), Lehigh Portland Cement Co. (Birmingham mill), Lone Star Cement Corp. (Birmingham mill), and Alpha Portland Cement Co. (Phoenixville mill) produced masonry and portland cements.

Tennessee Coal & Iron, Woodward Iron Co., U.S. Pipe & Foundry Co., and Republic Steel Corp. produced pig iron, and Tennessee Coal & Iron produced steel. Tennessee Coal & Iron (Wenonah mine) and Woodward Iron Co. (Pine mine) mined red iron ore. Tennessee Coal & Iron abandoned its red iron ore mines which had been operated continuously since 1876.

Eight quarries crushed limestone for cement, roadstone, agstone, fluxing stone, lime, stone sand, and refractories; the leading producers were Dolcito Quarry Co., Tennessee Coal & Iron, and Universal Atlas Cement. Tennessee Coal & Iron produced quicklime for chemical, industrial, and refractory uses. Six companies mined miscellaneous clay for cement and heavy clay products, the outstanding producers being Universal Atlas Cement and Lehigh Portland Cement Co.

Universal Atlas Cement and Sam P. Acton crushed sandstone for cement and refractories. W. S. Dickey Clay Mfg. Co. and Bibby Coal, Shale & Clay Co. mined fire clay for firebrick and block, and for fire-clay mortar. Wade Sand & Gravel Co. Inc., mined a small quantity of building sand and gravel. Zonolite Co. exfoliated vermiculite at its Birmingham plant.

Limestone.—The Limestone County Board of Revenue crushed limestone for roadstone.

Macon.—Sharpe Sand & Gravel Co. and Tri-State Sand Co. produced molding sand, and building, paving, and fill sand and gravel.

Madison.—Madison Limestone Co. (Pluski Pike and Airport quarries) crushed limestone for roadstone and agstone. Alabama Brick & Tile Co. and Huntsville Brick & Tile Co. mined mescellaneous clay for heavy clay products.

Marengo.—Lone Star Cement Corp. produced portland cement and crushed limestone for cement at Demopolis. Gulf States Paper Corp. regenerated lime at its papermill.

Marion.—Twenty-nine coal mines were active; the main producers were Brookside-Pratt Mining Co. (New River Strip mine), C. O. May Coal Co. (C. O. May mine), and Coalite, Inc., (Brilliant Strip mine). Thomas Alabama Kaolin Co. mined kaolin at Hackelburg. A small quantity of natural gas was produced.

Marshall.—C. A. Langford crushed limestone for concrete and roads.

Mobile.—Production of crude petroleum from 352 wells increased 10 percent, and 28 new wells totaling 321,146 feet were drilled. Ideal Cement Co. produced portland and masonry cements, and mined miscellaneous clay for cement. Southern Oystershell Milling Corp. and Radcliff Materials, Inc., dredged oystershells from Mobile Bay for cement, roadstone, and poultry grit. Radcliff Materials, Inc., also produced building and paving sand and gravel. International Paper Co. and Scott Paper Co. regenerated lime from paper milling.

Monroe.—Mannings Sand & Gravel Co. mined building sand and gravel.

Montgomery.—Six companies produced building, paving, railroad ballast and molding sand, and building, paving, and railroad ballast gravel; the major producers were Birmingham Slag and Alabama Gravel Co. Jenkins Brick Co. and Excelsior Brick Co. mined miscellaneous clay for heavy clay products.

Morgan.—Trinity Stone Co., Inc., and Waters Quarries, Inc., crushed limestone for roadstone, agstone, and riprap. Decatur Sand & Gravel Co. mined building and paving sand and gravel.

Pike.—Five companies mined brown iron ore for pig iron, the leading producers being Glenwood Mining Co. Inc., and Armco Mining Co.

Randolph.—Dixie Mines, Inc., mined scrap mica at the Dixie mine and a small quantity of sheet mica at the Bible mine.

Russell.—Bickerstaff Brick Co., Inc., Dixie Brick Co., and Bickerstaff Co. Inc., mined miscellaneous clay for heavy clay products. Consolidated Gravel Co. Inc., mined building, paving, and railroad ballast sand, and building and paving gravel.

St. Clair.—National Cement Co. produced masonry and portland cements at the Ragland mill. National Cement Co. and Clemment Bros. Construction Co. Inc., crushed limestone for roadstone and for cement. Ragland Brick Co. and National Cement Co. mined miscellaneous clay for cement and heavy clay products. Riverside Clay Co. (Riverside and Pell City mines) mined fire clay for foundries and steelworks.

Shelby.—Southern Cement Co. produced masonry and portland cements at the Calera mill. Five companies produced quicklime and hydrated lime for agricultural, building, chemical, and industrial uses; the leading producers were Southern Cement Co. (Roberta limekiln) and Longview Lime Corp. (Longview limekiln). Nine companies crushed limestone for concrete and roads, agstone, papermills, cement, lime, riprap, fluxing stone, magnesium reduction, railroad ballast, asphalt filler, rock dust for coal mines, and chemicals,

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leading producers were Southern Cement Co. (Roberta quarry) and Birmingham Slag (Calera quarry). Eleven coal mines were active, and the principal producer was Southern Electric Generating Co. (Segco No. 2 mine). Southern Cement Co. mined miscellaneous clay for cement. Shelby Sand & Ore Co. mined brown iron ore for pig iron.

Talladega.—Thompson-Weinman & Co., Moretti-Harrah Marble Co., and Alabama Marble Co. crushed marble for whiting, terrazzo, and other uses. Moretti-Harrah Marble Co. and Alabama Marble Co. quarried dimension marble for rough exterior; dressed and cut exterior and interior building stone; and dressed, cut and sawed interior building stone; and for dressed and cut monumental stone. Talladega Materials Co. Inc., crushed limestone for roadstone. James Rucker mined brown iron ore for pig iron. John B. Lagarde, Inc., produced building sand and gravel. American Talc Co. mined and ground talc at Winterboro. Kimberly-Clark Corp. regenerated lime at its papermill.

Tuscaloosa.—Nine coal mines were active; the leading producers were Twin Seam Mining Co. (Kellerman No. 4 strip mine) and C. L. Abston Coal Co. (strip mine). Southeastern Coal & Iron Co. mined red iron ore for pig iron at Dudley. Shook & Fletcher Supply Co. shipped brown iron ore from the Adkins mine for pig iron. Yazoo Gravel Co. Inc., Tuscaloosa Sand & Gravel Co., and Shackleford Construction Co. mined building, molding, and fill sand, and building gravel. Gulf States Paper Corp. regenerated lime at its papermill at Tuscaloosa.

Walker.—Fifty-one coal mines were active; the main producers were Southern Electric Generating Co. (Segco No. 1 mine), Alabama Power Co. (Gorgas mine), and Peabody Coal Corp. (Waterside strip mine). Four companies mined fire clay for firebrick and block, and the leading producers were Natco Corp. and Russell Coal & Clay Co.

Washington.—Lone Star Cement Corp. crushed limestone at the St. Stephens quarry and transported it to New Orleans for use in the manufacture of cement. Mathieson Alabama Chemical Corp. recovered salt from brine at the McIntosh plant.

Winston.—McCoy Coal Co. mined bituminous coal at the Winston strip mine.

The Mineral Industry of Alaska

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Department of Natural Resources, State of Alaska, for collecting information on all minerals except fuels.

By Kevin Malone,[1] Phil R. Holdsworth,[2] and Holly G. O'Brien[3]

PETROLEUM and natural gas again dominated the news of the mineral industries in Alaska, as they have since the Richfield Oil Corp. discovered oil at Swanson River in 1957. With Swanson River producing at almost full capacity throughout 1962 and production of gas from the Kenai unit more than doubling, value of oil and gas was $31.8 million compared with $17.8 million in 1961. At yearend, the Swanson River field had 50 producing oil wells, and the development of the field was nearly completed. Repressuring of the Swanson River field began in November. Gas from upper zones of the field, after compression, was injected into the Hemlock producing zone to maintain reservoir pressure. Standard Oil Co. of California, operator of Swanson River and Richfield, holder of a major interest, broke ground in June for a 20,000-barrel-per-day refinery on the Kenai Peninsula. The plant, expected to be in operation by mid-1963, planned to convert Swanson River crude oil to diesel and jet fuels and to heating and fuel oils. New gas discoveries were made at West Foreland and Middle Ground Shoal by Pan American Petroleum Corp., and at Beluga River by Standard of California. No new oilfields were discovered.

Value of mineral production in the State increased 56 percent. Oil and gas, increasing 79 percent over the figures for 1961, accounted for 59 percent of total value. Coal, with both tonnage and value well above the figures for the previous year, retained second rank. Military contracts for coal were slightly more in tonnage and slightly less in value than in 1961. The increases in total tonnage and value resulted from greater domestic and commercial consumption. Value of gold output was up sharply, replacing sand and gravel as the third ranking mineral commodity. Higher values per yard washed in some of the dredge fields of the State accounted for a 45 percent increase in value of gold produced. The increase did not appear to have any long-term significance, however. Except for the possible mining of a few remnants, dredging in the Nome fields was suspended with the close of 1962 operations. The major operator in the Fair-

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banks fields announced that operations there were to be suspended at the close of the 1963 season. Sand and gravel increased in tonnage and value. The Alaska Department of Highways accounted for the increases. Production of mercury, both physical volume and value, were lower than in 1961. Value per flask was $191.21 compared with $197.61 in 1961. As in past years, almost all of the Alaskan mercury was produced at the Red Devil mine of Alaska Mines and Minerals, Inc., Kuskokwim River region. Goodnews Bay Mining Co., again the only producer in the Nation with platinum as a primary product, continued operations at the placer deposits near Platinum, southwestern Kuskokwim River region. Output was maintained at the levels of recent years.

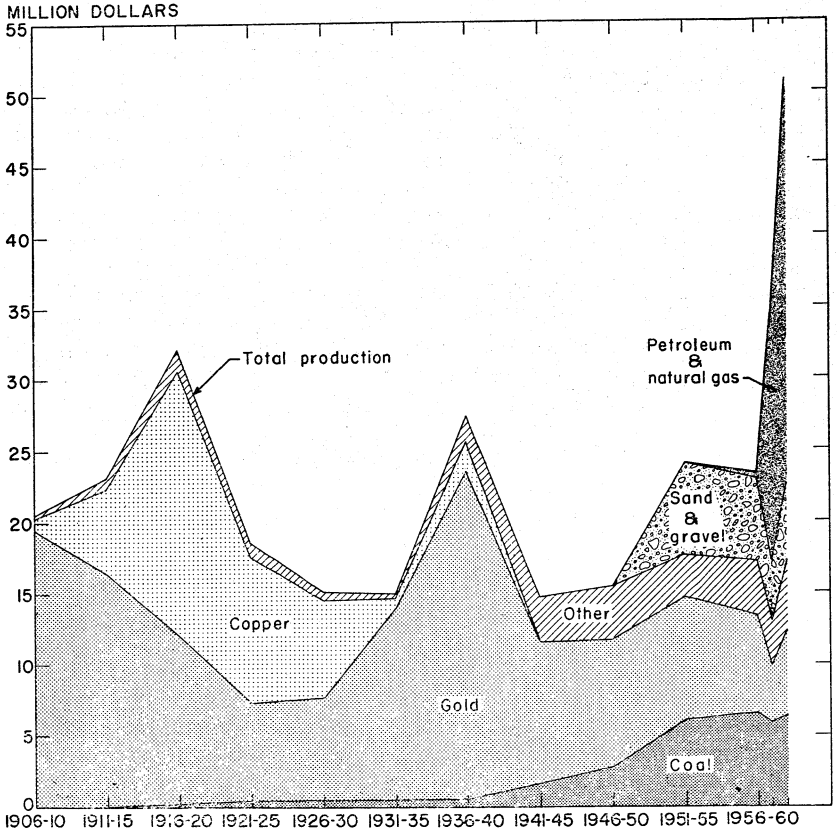

FIGURE 1.—Cumulative values of mineral production in Alaska by major commodities, 1906–60 (5-year averages), and 1961–62 (by year).

TABLE 1.—Mineral production in Alaska[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Coal (bituminous)—thousand short tons	737	$5,868	871	$6,409
Copper (recoverable content of ores, etc.)—short tons	92	55	----	----
Gold (recoverable content of ores, etc.)—thousand troy ounces	114	3,998	165	5,784
Mercury—76-pound flasks	4,129	816	3,719	711
Natural gas—million cubic feet	631	129	2,184	467
Petroleum (crude)—thousand 42-gallon barrels	6,327	17,652	[2] 10,260	[2] 31,190
Sand and gravel—thousand short tons	5,241	4,185	5,731	5,355
Silver (recoverable content of ores, etc.)—thousand troy ounces	18	17	22	24
Value of items that cannot be disclosed: Gem stones, lead (1961), peat, platinum-group metals, stone, and uranium	----	[3] 2,033	----	4,256
Total	----	[3] 34,753	----	54,196

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Preliminary figure.
[3] Revised figure.

TABLE 2.—Expenditures by major companies for exploration and prospecting

(Thousand dollars)

Type and region	1961	1962
Metals exploration:		
Southeastern Alaska	$1,000	$350
Copper River and Prince William Sound	20	----
Kuskokwim River and Yukon River	75	260
Northwestern Alaska	550	500
Other	125	190
Total metals	1,770	1,300
Oil and gas:		
Exploration	24,405	46,712
Development and production	18,000	18,788
Total oil and gas	42,405	65,500
Grand total	44,175	66,800

Source: Division of Mines and Minerals, Department of Natural Resources, Alaska.

Exploration expenditures for metals and nonmetals decreased 27 percent. Estimates for mineral exploration (excluding petroleum) by the Alaska Division of Mines and Minerals were $1.3 million, compared with $1.8 million in 1961. Deposits in the southeastern region continued to receive attention; iron, nickel-copper, and gold were the metals of principal interest. In central Alaska, work was done on the limestone deposits in the Kings River area and at nickel-copper deposits at Spirit Mountain, Chitina district. Various mining companies and individuals were engaged in prospecting and geological investigations. In the northwestern region, Bear Creek Mining Co., exploration subsidiary of Kennecott Copper Corp., completed another field season in its program of evaluating the huge copper deposits at Ruby Creek, Shungnak district. Interest in offshore placer deposits at the Seward Peninsula, Goodnews Bay (southwestern Kuskokwim

River region), and Stephens Passage (southeastern region) was high; gold and platinum were the metals of chief interest.

Employment.—The 166 mining and milling operations furnished employment for 1,627 men, including 104 men employed solely in assessment work, prospecting, or exploration and development. In addition, the oil industry employed 613 men in exploration and production.

TABLE 3.—Coastwise receipts and foreign mineral trade

Commodity	1960			1961		
	Coastwise receipts	Imports	Exports	Coastwise receipts	Imports	Exports
Anthracite, bituminous coal and lignite, coal and coke briquettes, and coke—short tons	815	20	--	894	10	--
Motor fuel and gasoline—thousand barrels	2,326	7	(1)	2,463	--	(1)
Gas, oil, distillate, and residual fuel oil—do	5,114	13	(1)	4,530	--	(1)
Petroleum asphalt—short tons	12,044	--	--	7,103	--	--
Lubricating oil and greases—thousand barrels	53	--	--	57	(1)	(1)
Petroleum products, not elsewhere classified—do	93	--	--	117	--	--
Building cement—376-pound barrels	377,539	36,793	--	318,705	39,810	--
Building monument, and other stone manufacturers, not elsewhere classified—short tons	1,904	--	--	5,679	--	--
Clays and earths—do	39	--	--	4,011	--	--
Brick and tile—do	1,310	--	--	1,908	--	--
Sulfur—do	--	7,952	--	--	4,143	--
Sand, gravel, and crushed rock, including limestone—short tons	14,306	--	--	44,005	--	--
Iron ore and concentrates—do	110	--	--	164	--	--
Iron and steel scrap—do	220	--	2,394	1,804	--	8,130
Iron and steel products—do	35,077	17,379	170	28,412	1,549	--
Aluminum metal and alloys in crude and semifabricated forms—short tons	724	--	--	291	--	--
Copper, semifabricated forms—do	743	--	--	475	--	--
Lead and lead-base alloys in crude and semifabricated forms—short tons	6	--	--	26	--	--
Other nonferrous ores, concentrates, metals, and scrap, except precious, in crude and semifabricated forms—short tons	--	--	--	100	--	30
Fertilizer materials—do	3,230	2,204	--	4,332	1,185	--

[1] Less than 500 barrels.

Source: Waterborne Commerce of the United States, Part 4, Pacific Coast, Alaska, and Pacific Islands, calendar years 1960–61, by the U.S. Army Corps of Engineers.

Injuries.—There were no fatalities chargeable to the mineral industries. Lost-time accidents decreased from 103 to 76. Of the lost-time accidents, 37, or approximately half, occurred at coal mines. The coal mines worked 54,600 man-days, compared with 168,000 man-days worked by other sections of the minerals industry. In petroleum exploration and production, four fatalities were recorded. Lost-time accidents totaled 109.

Wages and Hours.—Mines in Alaska operated an average of 137 days. This low figure for days operated resulted from the seasonal nature of many mining operations, and the number of men employed in assessment work and prospecting.

For the mineral industries covered by the Employment Security Act (operators with hired labor), monthly earnings averaged $842. Monthly earnings in metal mining were $677, in nonmetals $1,000, in coal mining $917, and in oil and gas (production and exploration) $889.

TABLE 4.—Number of establishments in the mineral industries in 1962, classified by number of employees

Type of operation	Number of establishments employing—			
	1–9	10–19	20–29	30 and over [1]
Metal mines [2]	107	5	2	4
Nonmetal mines	8	2	26	
Quarries and mills [3]	3			3
Coal mines	2		1	3
Total	120	7	29	10

[1] Includes 4 operations employing 30–39; 1 operation, 40–49; 1 operation, 50–59; 1 operation, 60–69; 1 operation 70–79; 1 operation, 80–89; and 1 operation, 100–109.
[2] Includes assessment, exploration, and development operations.

TABLE 5.—Employment and injuries in the mineral industries in 1962 [1]

Type of operation	Number of men working (average)	Number of days worked (average)	Man-days	Nonfatal injuries
Metal:				
Lode	28	279	7,815	13
Mills	5	310	1,551	2
Placer:				
Dredge	252	211	53,253	20
Nonfloat	91	100	9,107	1
Hydraulic	13	119	1,542	
Small-scale hand	7	41	290	
Assessment, exploration, development, and/or prospecting [2]	104	69	7,194	3
Nonmetal mines [3]	716	91	64,997	
Quarries and mills	223	100	22,248	
Coal	188	290	54,573	37
Total [4]	1,627	137	222,570	76

[1] Excludes officeworkers.
[2] Includes 32 men in placer assessment, exploration, development, and/or prospecting, 70 in lode, and 2 in limestone exploration.
[3] Sand and gravel operations.
[4] Does not include figures for the petroleum industry.

Legislation and Government Programs.—Legislation authorizing the U.S. Navy to make natural gas from the South Barrow field of Naval Petroleum Reserve No. 4 available to residents of Barrow was signed by President Kennedy late in August. The cost of a new well, estimated at $400,000, was to be recovered by the Navy from the sale of gas. Two wells at the South Barrow field were supplying Federal installations at Barrow. The Navy was barred from selling gas from the Petroleum Reserve by previous legislation.

Conversion of military bases at Anchorage from coal-fueled to gas-fueled heating and power plants was delayed when Alaska congressional delegates introduced bills in the Senate and House of Representatives to make coal and oil contractors eligible for 10-year fuel contracts. Under existing regulations, sellers of natural gas were permitted to bid for fuel and power contracts on a 10-year basis, whereas coal and oil producers were limited to 1-year contracts. The U.S. Defense Department had submitted a proposal to the U.S. Bureau of the Budget requesting supplemental funds for the conversion in the fiscal year 1963 budget.

Three exploration loans were executed under the Office of Minerals Exploration (OME) program. Little Squaw Mining Co. received a contract amounting to $167,750 for exploration of lode gold deposits in the Chandalar district, north of the Arctic Circle. This was the first OME assistance in gold exploration in Alaska since the regulations were liberalized in 1961 to include gold and silver.

OME also executed a $12,300 contract for the exploration of a gold placer on the Chena River, 80 miles east of Fairbanks. Both deposits were in the Yukon River region. In the Kuskokwim River region, Alaska Mines and Minerals, Inc., received a $324,100 OME contract for exploration work on a deposit in the Georgetown district. The OME participated to the extent of 50 percent of the above contracts; repayment to the Government was to be from royalties on ore discovered by the exploration work. If no ore was found, the Government contribution was to be canceled with no further liabilities to owners or operators.

Studies by the U.S. Army Corps of Engineers and other Government agencies on the proposed Rampart hydroelectric development on the Yukon River continued during 1962. The corps completed test drilling of foundation sites in the late spring and started on design studies for the proposed concrete gravity dam. The Bureau of Mines studied the mineral resources of the reservoir and surrounding area, a report on the Bureau findings was in process at yearend. Development and Resources Corp. of New York (D&R), under a contract with the Corps of Engineers, reported on the market for Rampart power. D&R took as the basic question of their study, "Can the power output of the Rampart project be marketed, if and when the project is built?" The answer was a firm "yes," based on the assumptions specified by the Corps of Engineers as to quantity (approximately 5 million kilowatts), cost (2 mills at the bus bar, 3 to 4 mills at tidewater), and schedule (full capacity by 1989).

Project Chariot, the proposal to construct a harbor at Cape Thompson on the Chukchi Sea using nuclear explosives, was deferred by the U.S. Atomic Energy Commission (AEC). Bowing to pressure from the Eskimos of northwestern Alaska, the Commission shelved the project, noting that some of the information that had been hoped for from the Chariot proposal was already available or might be obtained through other experiments and that the studies already made had provided useful information.

A Federal study of means to achieve coordinated and comprehensive resources planning in Alaska was ordered by President Kennedy late in 1962. The President's order followed a request by the Alaska congressional delegates for the creation of a Federal commission on Alaska resources development.

Transportation.—An examiner of the Federal Maritime Commission recommended denial of an application of Alaska Steamship Co. and Garrison Fast Freight, a division of Consolidated Freightways, Inc., for increased freight rates on shipments from Seattle to Alaska ports. The companies had applied for increases, from 10 to 20 percent in December 1961 despite the fact that approval of a 10-percent rate increase made in January 1960 was still under consideration by the Commission. A second Commission examiner recommended in April

that the January 1960 increase be denied. The examiner also recommended that the carriers involved not be required to refund money collected on the increase over the period while the decision was pending. Exceptions to the examiner's recommendations were entered by shippers, who contended that denial of the increase would result in a forced curtailment of service to Alaska. The State of Alaska and the U.S. General Services Administration filed exceptions to the findings that shippers not be required to refund the increase.

TABLE 6.—Freight rates,[1] Seattle to selected Alaskan cities

(Cents per hundred pounds)

Commodity	Seattle to—					
	Seward		Anchorage via Seward		Fairbanks via Seward	
	1961	1962	1961	1962	1961	1962
Machinery	160	178	317	522	431	675
Groceries	170	170	327	327	441	441
Do 24,000-pound minimum			260	260	344	344
Do 60,000-pound minimum			233	233	292	292
Diesel oil	150	114		307		421
Do 30,000-pound minimum			210	210	308	308
Ores and concentrates (southbound only) [2]	86	78				
Do [2] 20,000-pound minimum			135½	135½	171	171

[1] Rates include all-risk insurance.
[2] Value not to exceed $60 per ton. Rate increases 25 percent for each additional $60 (or fraction) per ton valuation.

Source: Alaska Steamship Co.

In May, the Alaska Railbelt was linked with the North American railroad system when Canadian National Railways started barge shipments of railcars from Prince Rupert, British Columbia, to Port Whittier. Reductions of $7 to $8 per ton on freight originating in the Midwestern United States, compared with rates through the Port of Seattle, were estimated for the new system. Advocates of the new service, known as seatrain, predicted that it was only a first step in the eventual direct linking of Alaska, through the Canadian rail system, with U.S. rail lines. The Defense Department was not in accord with the seatrain system. Acting under a protest from the Port of Seattle and a Washington congressional delegate, the Department banned movement of defense cargoes to Alaska over Canadian rail lines and piers.

As a counter to the Canadian sea-rail service, Alaska Steamship Co. proposed a plan using the foreign-built vessel *City of New Orleans* on the Washington-Alaska run. Special legislation was needed to permit use of the foreign-built vessel in U.S. coastwise trade. No clearance for the use of the *City of New Orleans* had been granted at yearend.

Construction of ferries for the Juneau-Haines to Prince Rupert, British Columbia, service was well underway at yearend. Delivery of the *Malaspina*, first of three vessels to be used in the ferry system, was scheduled for early 1963. The new system was to provide passenger, automobile, and freight service between Prince Rupert and southeastern Alaska port cities along the Inside Passage.

Under the Area Redevelopment Administration program, construction was started at Saxman (near Ketchikan) on a marine terminal facility for handling freight cars shipped by oceangoing barge. The rail-car-barge service was expected to lower substantially freight costs both for Alaska-bound freight and for outgoing shipments of salmon, pulp, and other commodities. Completion of the terminal was scheduled for early 1963.

Transfer of all highway functions from the Department of Public Works to the Department of Highways was completed in September. For fiscal year 1963, the value of road construction projects advertised by the highway department was $60 million. Major construction was accomplished on the Copper River Highway north of Cordova and south from Chitina, the new Anchorage-Fairbanks link via McKinley Park, and the Chena Hot Springs road. A feasibility study of a crossing of Turnagain Arm was undertaken. The first phase of an economic study for use in locating a route between central and western Alaska (the Fairbanks-Nome road) was completed. As the year closed, the highway system consisted of 1,638 miles of primary roads and 2,650 miles of secondary roads. Not included in the totals were national park, forest development, mining, military, and oilfield roads. There were also 235 miles of dogsled trails which the department winterstaked.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—Rehabilitation of mine and mill plant at the Stampede mine, northeast of Kantishna, Yukon River region, was completed during 1962. The operator stated that shipments of ore and concentrate were to be made to Japan in 1963 under a contract signed earlier. At the Polaris deposit on Bedrock Creek, Yukon River region, exploration consisted of stripping, trenching, and drifting. There was no record of antimony shipments from Alaska in 1962.

Beryllium.—Prospecting activity in beryllium was stimulated by announcement by the Geological Survey of two discoveries on the Seward Peninsula in the Lost River area. At Rapid River, a west-trending tributary of Lost River, beryllium mineralization was found along the contacts of dikes intruded into limestone. In the Lost River Valley, about a mile below the Lost River tin mine and 4 miles northeast of the Rapid River discovery, good beryllium showings were found in float and in place in an east-west zone 1,000 feet wide by 4,200 feet long. The mineralization is associated with dikes and fractures. Individual mineralized zones are up to 30 feet wide and several hundred feet long. Other scattered showings were reported over a distance of about 6 miles.

Copper.—No copper was produced in Alaska in 1962. Examination and exploration of deposits in southeastern Alaska, Copper River, and northwestern Alaska regions continued. Japanese interests sent a six-man survey team to examine mineral deposits in the Copper River, Cook Inlet-Susitna, and southeastern Alaska regions. Copper and copper-nickel deposits were of primary interest. Members of the

survey team were associated with the Overseas Mineral Resources Development Cooperative Association of Japan, an organization sponsored by the Japanese Ministry of International Trade and Industry.

Gold.—The output of the Alaska gold industry reversed a 12-year trend and increased to $5.8 million, compared with $4.0 million in 1961. The increase held little promise of a revival of gold mining; instead it appeared to be only a spasm of a dying industry. Major dredging operations in the Nome district were announced as ended with the close of the 1962 season. In the Fairbanks dredge fields, one major operator announced that activity was to cease at the close of the 1963 season. With reduced activities in the two districts, gold mining in Alaska was expected to decline—as it has in all the States except South Dakota—to relative insignificance in the economy of the State.

TABLE 7.—Mine production of gold, silver, and other metals,[1] in terms of recoverable metals[2]

Year	Mines producing		Material sold or treated[3] (short tons)	Gold (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)
1953–57 (average)	4	129	7,199	235,270	$8,234
1958	3	108	55	186,435	6,525
1959	2	94	617	178,918	6,262
1960	6	92	234	168,197	5,887
1961	8	86	645	114,216	3,998
1962	1	66	162	165,259	5,784

Year	Silver (lode and placer)		Other		Total value (thousands)
	Troy ounces	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	32,000	$29	5	$2	$8,265
1958	23,507	22	7	3	6,550
1959	21,358	19	36	22	6,303
1960	25,934	23	64	32	5,942
1961	18,485	17	116	60	4,075
1962	22,199	24	----	----	5,808

[1] Includes copper, lead, and zinc produced.
[2] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes retreated, and ore shipped to smelters during calendar year indicated.
[3] Does not include gravel washed.

U.S. Smelting, Refining, and Mining Co. operated two dredges at Fairbanks, two at Nome, and one each at Hogatza River and Chicken Creek (both Yukon River region). New York-Alaska Gold Dredging Corp. continued dredging on the Tuluksak River, Aniak district, Kuskokwim River region. Miscovich Bros. again dredged on Otter Creek, Iditarod district, Yukon River region. Other dredges were active on Woodchopper Creek (Circle district, Yukon River region), Kougarok River (Kougarok district, Seward Peninsula region), Inmachuk River (Fairhaven district, Seward Peninsula region), and Solomon River (Nome district, Seward Peninsula region). Wolf Creek Mining Co. on Wolf Creek (Fairbanks district, Yukon River region), Prince Creek Mining Co. on Prince Creek (Iditarod district,

Yukon River region), Spruce Creek Mining Co. on Spruce Creek (Innoko district, Yukon River region), and Fullerton Bros. on Flat Creek (Iditarod district, Yukon River region) all operated nonfloat plants. Hassel Mining Co. worked a hydraulic placer on Ready Bullion Creek (Fairbanks district, Yukon River region).

Changes in State mining regulations, enacted in 1961, were responsible for a sudden surge of interest in offshore placers. The new regulations provided for the granting of offshore prospecting permits, giving a prospector or exploration company as much as 2 years to test a given tract. The permittee was protected during the testing period and could obtain a lease from the State on valuable minerals found.

TABLE 8.—Fifteen leading gold-producing mines in 1962, in order of output

Rank in 1962	Rank in 1961	Mine	District	Region	Operator	Source of gold
1	1	Fairbanks Unit	Fairbanks	Yukon River	United States Smelting, Refining & Mining Co.	Dredge (2).
2	2	Nome Unit	Nome	Seward Peninsula.	do	Do.
3	3	Hogatza River	Hughes	Yukon River	do	Dredge (1).
4	4	Chicken Creek	Fortymile	do	do	Do.
5	5	Nyac	Aniak	Kuskokwim River.	New York-Alaska Gold Dredging Corp.	Do.
6	8	Woodchopper Creek.	Circle	Yukon River	Mathews Mining Co	Do.
7	6	Otter Creek	Iditarod	do	Otter Dredging Co	Do.
8	9	Prince Creek	do	do	Prince Creek Mining Co.	Nonfloat.
9	7	Wolf Creek	Fairbanks	do	Wolf Creek Mining Co	Do.
10	(1)	Kougarok River	Kougarok	Seward Peninsula.	Martinsen Brothers	Dredge (1).
11	(1)	Spruce Creek	Innoko	Yukon River	Spruce Creek Mining Co.	Nonfloat.
12	(1)	Ready Bullion Creek.	Fairbanks	do	Hassel Mining Co	Hydraulic.
13	10	Flat Creek	Iditarod	do	Flat Creek Placers	Nonfloat.
14	15	Inmachuk River	Fairhaven	Seward Peninsula.	Inmachuk Mining Co	Dredge (1).
15	12	Solomon River	Nome	do	Lee Bros. Dredging Co	Do.

[1] Not among the 15 highest in 1961.

Submerged placers off Nome and the coast of Norton Sound, as far south and east as Shaktolik, received the most attention. At Nome, Shell Oil Co. filed on 5,120 acres, reportedly 1.5 miles offshore. The sea off Nome and eastward along Norton Sound is relatively shallow, depths 2 miles offshore in this area are 60 feet or less. At 3 miles from shore, however, some depths are 300 feet. Shell did some mapping and conducted seismic and other geophysical surveys to obtain information on the physical characteristics of submerged deposits. Results of the work indicated "some favorability" that commercial gold placers existed. A decision to follow through with a sampling program was dependent upon further study of the geophysical data.

TABLE 9.—Gold produced at placer mines, by classes of mines and methods of recovery

Class and method	Mines producing [1]	Material treated (thousand cubic yards)	Gold recovered		
			Troy ounces	Value	Average value per cubic yard
Surface placers:					
Gravel mechanically handled:					
Bucketline dredges:					
1953–57 (average)	13	12,737	185,367	$6,487,831	$0.509
1958	13	16,043	150.342	5,261,970	.328
1959	13	12.478	146,886	5,141,010	.412
1960	15	12,988	138,620	4,851,700	.374
1961	16	10,315	94,488	3,307,080	.320
1962	16	8,061	147,766	5,171,810	.642
Nonfloating washing plants:					
1953–57 (average)	82	2,873	46,928	1,642,466	.572
1958	78	2,077	34,664	1,213,240	.584
1959	64	1,578	30,307	1,060,745	.672
1960	60	1,229	26,602	931,070	.758
1961	57	773	16,209	567,315	.734
1962	37	741	14,942	522,970	.705
Gravel hydraulically handled:					
1953–57 (average)	13	66	1,010	35,343	.532
1958	9	34	567	19,845	.587
1959	8	25	522	18,270	.729
1960	11	43	1,447	50,645	1.178
1961	10	39	2,673	93,555	2.378
1962	7	41	2,194	76,790	1.861
Small-scale hand:					
1953–57 (average)	21	25	729	25,522	1.037
1958	8	14	662	23,170	1.657
1959	9	11	585	20,475	1.895
1960	6	1	153	5,355	5.366
1961	3	1	87	3,045	2.643
1962	6	3	64	2,240	.844
Underground placers (drift):					
1953–57 (average)	1	(2)	11	392	3.267
1958–62					
Grand total placers:					
1953–57 (average)	130	15,701	234.045	8,191,554	.522
1958	108	18,168	186,235	6,518,225	.359
1959	94	14,092	178,300	6,240,500	.443
1960	92	14,261	166,822	5,838,770	.409
1961	86	11,128	113,457	3,970,995	.357
1962	66	8,846	164,966	5,773,810	.653

[1] Excludes itinerant prospectors, "snipers," "highgraders," and others who gave no evidence of legal right to property.
[2] Less than 500 cubic yards.

TABLE 10.—Mine production of gold and silver in 1962, by months, in terms of recoverable metals [1]

Month	Gold (troy ounces)	Silver (troy ounces)	Month	Gold (troy ounces)	Silver (troy ounces)
January			August	30,672	5,092
February			September	29,515	3,987
March	430	71	October	33,168	4,366
April	2,462	480	November	13,171	1,734
May	7,966	1,321	December	2,446	333
June	20,690	2,378			
July	24,739	2,437	Total	165,259	22,199

[1] Derived from mint and smelter receipts and producers' reports.

TABLE 11.—Production of gold and silver at placer mines in 1962, by regions and districts

Region and district	Mines producing	Gold (troy ounces)	Silver (troy ounces)	Total value
Cook Inlet-Susitna: Valdez	1	3		$105
Copper River: Yakataga	1	11	1	386
Kuskokwim River: Bethel	1	3	1	106
Northwestern Alaska: Kiana	1	355	40	12,468
Seward Peninsula:				
Council	1	473	49	16,608
Fairhaven	5	2,027	261	71,228
Kougarok	3	1,722	169	60,453
Koyuk	2	418	32	14,665
Yukon River:				
Circle	6	4,170	435	146,422
Koyukuk	3	684	64	24,010
Melozitna	1	151	16	5,302
Rampart	1	43	4	1,509
Ruby	2	938	137	32,979
Tolovana	1	603	40	21,149
Other districts [1]	37	153,365	20,883	5,390,433
Total	66	164,966	22,132	5,797,823

[1] Includes 3 districts for which production was unreported by producer and the following districts for which quantities and values cannot be shown separately: 4 mines in Aniak, Kuskokwim River region; 5 in Nome, 1 in Port Clarence, Seward Peninsula region; 6 in Fairbanks, 4 in Fortymile, 4 in Hot Springs, 1 in Hughes, 4 in Iditarod, 7 in Innoko, 1 in Kantishna, Yukon River region.

TABLE 12.—Production of gold, silver, and other metals [1] at lode mines, in terms of recoverable metals

Year	Mines producing	Gold		Silver		Other		Total value (thousands)
		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	4	1,226	$43	832	$1	5	$2	$46
1958	3	200	7	587	1	7	3	11
1959	2	618	22	869	1	36	22	45
1960	6	1,375	48	3,044	3	64	32	83
1961	8	759	27	3,697	3	116	60	90
1962	1	293	10	67	[2]			10

[1] Includes copper, lead, and zinc.
[2] Less than $500.

TABLE 13.—Equipment used at placer gold mines in 1962, by regions

Region	Number of operations [1]	Gravel washed (thousand cubic yards) [2]	Equipment used (number)				
			Bulldozers	Draglines	Hydraulic giants	Dredges	Other [3]
Cook Inlet-Susitna	2		2		1		
Copper River	3						
Kuskokwim River	6	1,005	3		2	2	2
Northwestern Alaska	1	36				1	
Seward Peninsula	22	2,755	27		16	9	1
Southeastern Alaska	1						
Yukon River	59	5,050	62	17	52	8	6
Total	94	8,846	94	17	71	20	9

[1] Includes equipment at 1 operation from which gold is a byproduct of platinum-group recovery and at 27 operations which conducted assessment, maintenance, or preparatory work but made no valuable mineral recovery.
[2] Partly estimated.
[3] Includes power units and diesel pumps.

In the Nome area, Nome Gold Coast, Inc., filed on some 36 miles along the coast and from shoreline out to 1.5 miles. Gold Coast drilled 17 holes through the ice with a Keystone drill early in 1962. Results were considered to be encouraging. Drilling showed 8 feet of fine sand on a 6- to 12-inch false bedrock of clay with fine gold concentrated on the clay. Below the clay streak the material was coarser and more angular with little gold until bedrock. Values on bedrock were reported as good.

Filings were also made on submerged placers in Stephens Passage, south of Grand Island (southeastern Alaska region), at Kodiak Island, in Goodnews Bay, and in Turnagain Arm (Cook Inlet-Susitna region). No public reports of exploration results were made. The Goodnews Bay area was of interest primarily for the possible platinum values contained, gold was expected to be a byproduct of any operations.

There were some indications of increased interest in lode gold properties. Scouts for a few larger mining companies were again examining gold lodes. In the Chandalar district, north of the Arctic Circle, Little Squaw Mining Co. explored high-grade showings under an OME loan. The Little Squaw project was the first gold property in Alaska to qualify for exploration assistance under Government programs. Output of lode gold in Alaska was very small in 1962. The State had no significant lode output since World War II conditions caused gold mining to stop.

Iron Ore.—Interest continued in the iron deposits of the State. In southeastern Alaska, work was done at Union Bay (Cleveland Peninsula), Klukwan (Haines), Port Snettisham (south of Juneau), and Kasaan Peninsula (Prince of Wales Island). In connection with a study of the mineral resources of the area surrounding the proposed Rampart hydroelectric project on the Yukon River, the Bureau of Mines made a reconnaissance examination of the hematitic red beds on the Tatonduk River, Black district, Yukon River region.

Mercury.—The value of mercury output declined 13 percent. Physical volume was 3,719 flasks, compared with 4,129 in 1961, a decrease of 10 percent. The lower average price for mercury in 1962 accounted for the greater decline in value. Alaska Mines and Minerals, Inc., operator of the Red Devil mine in the Kuskokwim River region, again produced almost the entire State output. The Bureau of Mines continued exploration of the White Mountain prospect, 60 miles southeast of McGrath, Kuskokwim River region.

TABLE 14.—Mercury production

Year	Number of producing mines	76-pound flasks	Value [1]	Year	Number of producing mines	76-pound flasks	Value [1]
1953-57 (average)	2	1,974	$499,495	1960	3	4,459	$939,779
1958	2	3,380	774,223	1961	2	4,129	815,932
1959	2	3,743	851,458	1962	2	3,719	711,110

[1] Value calculated at average New York price.

Nickel.—Japanese engineers associated with the Overseas Mineral Resources Development Cooperative Association examined the Spirit Mountain deposit (near Chitina), Copper River region, and the Rainbow Mountain deposit (near McCallum), Yukon River region. Examinations were also made of nickel-copper deposits in the southeastern Alaska region. Exploration continued on the Spirit Mountain and Rainbow Mountain properties and on the Brady Glacier and Funter Bay deposits in southeastern Alaska.

Platinum-Group Metals.—Goodnews Bay Mining Co. was again the only producer of platinum as a primary product in the Nation. The company had dredging operations in the extreme southwestern part of the Kuskokwim River region. New State regulations providing for offshore prospecting permits stimulated interest in the submerged placers in Goodnews Bay. Fremont Mining Co., was granted offshore permits at Goodnews Bay. The company did some seismic and other geophysical work in 1962 and planned an extensive program for the 1963 field season.

Scrap Metals.—Small quantities of ferrous and nonferrous scrap were shipped from the State. Most of the ferrous scrap was shipped from Anchorage to Japan.

Silver.—Output of silver, following that of gold, increased to 22,000 ounces from the 18,000 ounces produced in 1961. Alaska silver production was largely a byproduct of gold placering. Exploration for lode silver deposits in the Yukon River and southeastern Alaska regions continued.

Tungsten.—Activity at tungsten deposits was limited to assessment work. World tungsten markets were unfavorable for domestic producers.

Uranium.—The Ross-Adams deposit on Bokan Mountain, Prince of Wales Island, southeastern Alaska, produced its quota of uranium and changed over to straight exploration and development work for the last few months of 1962. There was little interest in prospecting for uranium.

MINERAL FUELS

Coal (Bituminous).—Coal ranked second to petroleum and natural gas in value of production. As had been the situation for a number of years, the U.S. Armed Forces were the chief consumers of Alaska coals. Military contracts for the fiscal year 1963 totaled 579,120 tons, compared with 577,000 tons for fiscal year 1962. Usibelli Coal Mine, Inc., operating an open pit and an underground mine in the Healy River field, was the leading contractor with 359,120 tons. Evan Jones Coal Co., a strip operator in the Matanuska field, supplied 160,000 tons to the military, and Mrak Coal Co., another strip operator in the Matanuska field, supplied 60,000 tons.

Strip mines produced 87 percent of Alaska coal, compared with 85 percent in 1961. In November, Usibelli Coal shut down the Suntrana underground mine at Nenana (Healy River). Suntrana was the only underground coal mine producing more than 1,000 tons in the State. Thus, the change to all strip coal in Alaska seemed to be completed. The leading coal producer in Alaska in 1950 was an underground operator, and six underground mines accounted for more than half of

the coal produced. In 1955, six underground operators were still able to mine, but underground coal had decreased to 37 percent of the production. By 1960, only one underground mine was operated, and strip coal accounted for 91 percent of all coal produced.

TABLE 15.—Coal production by fields

(Thousand short tons and thousand dollars)

Year	Matanuska		Nenana		Barrow		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1955	258	$3,055	381	$2,690	1	$14	640	$5,759
1956	269	3,273	457	3,055	1	46	727	6,374
1957	237	2,947	604	4,337	1	12	842	7,296
1958	290	3,532	468	3,392	1	7	759	6,931
1959	251	2,977	409	2,892	----------	----------	660	5,869
1960	300	3,434	422	2,884	----------	----------	722	6,318
1961	226	2,443	511	3,425	----------	----------	737	5,868
1962	309	2,871	562	3,538	----------	----------	871	6,409

An estimated 66 percent of coal sold was used for heat and power at Fort Wainwright and Eielson Air Force Base near Fairbanks, at Fort Richardson and Elmendorf Air Force Base near Anchorage, at Clear Missile Tracking Station near Nenana, and at other military installations in Alaska. Additional quantities were sold to local utility companies for heat and power and to consumers for heating and cooking. The average unit value of all coal produced was $7.35 per ton, compared with $7.96 per ton in 1961. The price trend in Alaska coal, after reaching the $9.81-per-ton peak in 1953, under the influence of the Korean conflict, had been downward. Alaska coal was back to the price level of 1950 at the $7.35-per-ton figure.

Five strip mines and one underground mine were active, compared with four strip mines and one underground mine in 1961. Of total coal output, the Nenana field produced 64 percent, compared with 36 percent for the Matanuska field. The Suntrana mine in the Nenana field produced 13 percent of total Alaska output before it was closed in November. Of the total tonnage mined, 43 percent was cleaned, compared with 40 percent in 1961.

Two private companies explored coal deposits in the Beluga River field under State exploration permits. Columbia Iron Mining Co., a subsidiary of U.S. Steel Corp., had a three-man crew prospecting the area during much of the 1962 field season. In applying for prospecting permits, the company stated that the purpose was to "evaluate the land as a source of fuel for metallurgical application in processing Alaska iron ore and other steel-making purposes as well as for power generation." Utah Development Co., a subsidiary of Utah Construction and Mining Co., used a mobile drill to explore the Beluga River coals. After evaluating drilling results, Utah Construction relinguished its exploration permits at Beluga. The Bureau of Mines examined the Beluga River field in 1960–61. An open-file report was released in April 1962, and a Report of Investigations will be published.

Petroleum and Natural Gas.—Offshore exploratory drilling in Cook Inlet was featured in the news of the petroleum industry in 1962.

Evidence of the strong interests of major oil companies in submerged inlet lands had been shown at the State's seventh competitive oil and gas lease sale held in December 1961, when bids totaled $15 million, almost double the estimate of State officials. Three offshore rigs, the first offshore equipment in Alaska waters, were operated in Cook Inlet during the 1962 season.

Shell Oil Co., as the operator for a combine including Standard Oil Company of California and Richfield Oil Corp., used the *Cuss II*, the largest free-floating, offshore-drilling ship in the world to drill SRS-State 1 in upper Cook Inlet. The well was drilled to deeper than 14,000 feet before being suspended in early fall as a precautionary measure to avoid loss or damage from winter storms and tides. Shell planned to modify wellhead equipment to handle high gas pressures encountered in the hole before resuming drilling in the spring. No results of the drilling were released, but local oil people speculated that the well might be a major oil discovery in the inlet. *Cuss II*, which was built for Global Marine Exploration Co. in Louisiana and moved through the Panama Canal to Alaska, was designed to drill in more than 200 feet of water and to depths of more than 15,000 feet. The ship was the first major drilling vessel designed and built new from the hull up for open-sea drilling.

In the Middle Ground Shoal area of Cook Inlet, Pan American Petroleum Corp. used a Western Offshore Drilling & Exploration Co. platform tender arrangement to drill Middle Ground Shoal-State 1. Sinclair Oil & Gas Co., Phillips Petroleum Co., and Skelly Oil Co. were joint venturers. The platform tender was towed from the Gulf of Mexico to Alaska via the Panama Canal. Middle Ground Shoal-State 1 tapped high-pressure gas at a reported 1,500 feet. Shutoff of the gas flow at the wellhead resulted in a blowout some 400 feet from the collar. The escaping gas formed a crater 1,000 feet across, the rim of which was above water level at low tide. Attempts to control the gas were unsuccessful, and the well was plugged. The well was certified by the Division of Lands as a gas discovery.

Pan American, with the same group of associates, spudded Cook Inlet-State 1 in the inlet opposite Tyonek. When the well had been drilled below 12,000 feet, a wellhead failure resulted in a spectacular blowout. Efforts to control the well were unsuccessful. The drilling barge was cut loose, and the gas was ignited to prevent pollution in the inlet and to eliminate the hazard to navigation from an unlighted blowout. The gas was still burning at yearend. A company spokesman estimated about 5 million cubic feet of gas and 50 barrels of condensate were being lost daily. Pan American immediately spudded Cook Inlet-State 1A, a directionally drilled relief well some 1,500 feet northeast of the blowout, to control the gas flow. In a race against the winter elements, the relief well was within a few hundred feet of connecting with the out-of-control well when high winds, driving ice floes out of Cook Inlet, moved the drill barge off location and forced suspension of drilling. Pan American expected to complete the relief well and kill the blowout as soon as drilling could be resumed in the spring.

TABLE 16.—Production of crude petroleum and natural gas

Year	Crude petroleum		Natural gas [1]	
	Thousand barrels	Value (thousands)	Million cubic feet	Value (thousands)
1958	[2]	[2]	50	$6
1959	187	$295	133	16
1960	559	1,230	246	30
1961	6,327	17,652	631	129
1962	[3] 10,260	[3] 31,190	2,184	467

[1] Comprises gas either sold or consumed by producers, including losses in transmission, quantities added to storage and increases of gas in pipelines.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Preliminary figure.

TABLE 17.—Exploration drilling for petroleum in 1962

Unit	Location	Company	Wells							
			Drilling start of year	Spudded	Completions	Drilling end of year	Gas	Plugged and abandoned	Other	Feet drilled
Swanson River.[1]	Kenai Peninsula.	Standard-Richfield.		2	1	1		1		21,811
Soldatna Creek.[1]	do	do		2	1			1	[2]	26,431
Sterling	do	Union-Marathon.		1	1			1		5,634
Ninilchik	do	do		1	1			1		14,940
Middle Ground Shoal-State.	Cook Inlet	Pan American		1	1		1			[3]
Cook Inlet-State.	do	do		2					[2 4]	[3]
SRS-State	do	Shell		1					[2]	14,041
Beluga River	Tyonek	Standard		2	2		2			22,228
West Foreland	do	Pan American	1		1		1			1,537
Stedatna Creek-State	do	do	1		1			1		2,280
Tyonek-State	do	do		1		1				[3]
Chuit-State	do	Superior	1	1	2			2		[3]
West Fork	Kenai Peninsula.	Standard		1	1			1		9,150
Anchor Point	do	do		1	1			1		14,704
South Diamond Gulch.	do	Occidental		1	1			1		10,568
Chaix Hills	Icy Bay	Standard	1		1			1		4,689
Riou Bay	do	do		1	1			1		14,107
Bering River	Yakataga	Richfield	1		1			1		1,184
White River	do	do		1	1			1		12,417
Malaspina	Yakutat	Colorado O&G		2	2			2		15,625
Pittman	Wasilla	Union		1	1			1		6,136
Bell Island	Susitna River	British American.		1	1			1		11,364
Nenana	Nenana	Union		1	1			1		3,062
Tazlina	Lake Louise	do		1	1			1		8,837
Eureka	Copper River	Aledo Oil		1		1				6,390
Wide Bay	Alaska Peninsula.	Richfield		1		1				1,215
Total			5	27	24	4	4	20	4	228,350

[1] The 2 units together are the Swanson River field.
[2] Suspended.
[3] Footage not released.
[4] Blowout, not under control at yearend.

Source: Alaska Division of Mines and Minerals.

TABLE 18.—Acreage under oil and gas lease

Year	Thousand acres	Year	Thousand acres
1954	1,833	1959	34,265
1955	2,519	1960	33,287
1956	2,815	1961	26,808
1957	6,516	1962	19,550
1958	27,900		

Source: 1954–58, Bureau of Land Management; 1959–62, Geological Survey, U.S. Department of the Interior.

Besides the Middle Ground Shoal-State gas discovery and the high gas pressures reported from SRS-State 1, gas discoveries were made by Pan American at West Foreland, near Tyonek, and by Standard of California in the Beluga River unit at the head of Cook Inlet, west of Anchorage. At West Foreland, the well was drilled to 13,500 feet with no oil show; the gas zone was well above the hole bottom. At the Beluga River unit, Standard drilled the discovery well, Beluga River 1, to 16,428 feet, which made it the deepest hole in Alaska by more than 1,000 feet. The well flowed 4.3 million cubic feet through a 0.25-inch choke from about 4,800 feet. Standard was testing other zones as the year closed. Use of Beluga gas to supplement Swanson River gas in the repressuring of the Swanson River oilfield was under study at yearend. A 30-mile marine pipeline across Cook Inlet to Swanson River would be required.

Results of wildcatting elsewhere in the State were not so encouraging. In the Gulf of Alaska, Richfield drilled dry holes at Bering and White Rivers in the Yakataga area. Standard of California had dry holes at the Chaix Hills and Riou Bay units at Icy Bay. Two wells drilled by Colorado Oil & Gas Corp. in the Malaspina unit at Yukutat were also dry holes. On the Kenai Peninsula, wells drilled at West Fork, Anchor Point, Sterling, Ninilchik, and Homer, as well as stepout wells at the Swanson River and Soldatna Creek units, were plugged and abandoned. In central and south-central Alaska, dry holes were drilled at Nenana, Wasilla, Lake Louise, Bell Island, and Tyonek. Exploration drilling for 1962, not including wells where footage was not released, was 228,350 feet, and development drilling was 80,000 feet. The comparable figures for 1961 were 179,000 and 314,000 feet. With the development of the Swanson River field almost completed at yearend, the dropoff in development drilling was not unexpected. At the close of the year, two development wells were being drilled at Swanson River, and permits had been issued for two additional wells. Geophysical and geological fieldwork was conducted at Port Moller, Ugashik, Porcupine River, Yukon Flats, and the Kandik River area. About 139 crew-months were spent in fieldwork, compared with 146 crew-months in 1961. Estimated expenditures by the oil industry, including exploration, development, production, and refinery construction, were $65.5 million. The 1961 figure was $42.4 million.

Production in 1962 included the first full year of output from the Swanson River field. When the year began, production was at a rate of 26,000 barrels per day. By yearend, production had stabilized at 29,000 barrels per day. The Swanson-Nikiski pipeline had a rated

capacity of 30,000 barrels per day and an optimum daily operating rate of 28,000 barrels.

Six new development contracts, covering 2,341,000 acres, were approved during 1962. Ohio Oil Co. (later Marathon Oil Co.), Union Oil Co., and Pure Oil Co. received a contract on 197,000 acres in the Middle Tanana Basin; Union-Ohio was awarded 542,000 acres at Crosswind Lake (near Glennallen); Gulf Oil Corp. obtained 592,000 acres at Port Moller on the Alaska Peninsula; Richfield won 167,000 acres at Chedatna Lakes, 50 miles west of Anchorage; Atlantic Refining Co. received 231,000 acres east of Umiat, next to Naval Petroleum Reserve No. 4 on the Arctic Slope; and Sinclair Oil & Gas Corp. and British Petroleum Corp. were awarded 612,000 acres in the Chandler River area, also on the Arctic Slope. Richfield relinquished about 1 million acres in the Katalla-Yakataga area. Colorado Oil & Gas Corp. dropped 185,000 acres in the Icy Bay-Cape Fairweather area, but retained 350,000 acres in that area. At the close of 1962, there were 9,846 oil and gas leases covering 19.6 million acres under the supervision of the U.S. Department of the Interior.

NONMETALS

Gem Stones.—Small quantities of raw jade, valued at $3 per pound, and a few ounces of specimen gold and platinum in nugget form were reported. The jade was from Dall Creek, a tributary to the Kobuk River (Shungnak district, northwestern Alaska region). Nugget gold for sale as specimens was produced at Manley Hot Springs (Hot Springs district, Yukon River region); nugget platinum was reported from the Goodnews Bay district (Kuskokwim River region).

Sand and Gravel.—Fourth in value among the mineral commodities of the State was sand and gravel. Commercial producers accounted for 9 percent of the tonnage and 18 percent of the value, compared with 12 and 28 percent, respectively, in 1961.

Average value per ton of all sand and gravel was $0.93. Of total output, 689,000 tons (12 percent) valued at $2.76 per ton was washed, compared with 824,000 tons (16 percent) valued at $2.11 per ton in 1961. Value of unwashed sand and gravel was $0.69 per ton ($0.55 in 1961). Ten commercial operators and nine Federal and State agencies or their contractors produced sand and gravel, compared with nine commercial and nine Government-and-contractor producers in 1961. Commercial producers included the Alaska Railroad, an agency of the U.S. Department of the Interior. The railroad was classified a commercial producer to permit comparability with data published for other States.

Of 533,000 tons produced by commercial operators, 266,000 tons (50 percent) valued at $2.73 per ton was washed; the value of unwashed material was $0.89 per ton. For Federal and State agencies, output was 5.20 million tons, of which 424,000 tons (8 percent) valued at $2.77 per ton was washed; unwashed material was valued at $0.67 per ton. The Alaska Department of Highways, the Federal Aviation Agency, and the Bureau of Public Roads were the major producers. The Alaska Department of Highways furnished 67 percent of the tonnage credited to State and Federal agencies and 63 percent of the value.

TABLE 19.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Structural	99	$310	81	$274
Fill			33	30
Other [1]	24	60	14	48
Total	123	370	128	352
Gravel:				
Structural	70	236	106	296
Paving	59	90	26	53
Railroad ballast	63	60	35	23
Fill	146	167	217	205
Other	168	254	21	36
Total	506	807	405	613
Total sand and gravel	629	1,177	533	965
Government-and-contractor operations:				
Sand:				
Structural	6	20	31	204
Paving	412	449	109	149
Other	24	53	6	7
Total	442	522	146	360
Gravel:				
Structural	69	22	136	467
Paving	2,042	1,443	2,372	2,421
Fill	2,059	1,021	2,544	1,142
Total	4,170	2,486	5,052	4,030
Total sand and gravel	4,612	3,008	5,198	4,390
All operations:				
Sand	565	892	274	712
Gravel	4,676	3,293	5,457	4,643
Total	5,241	4,185	5,731	5,355

[1] Includes "Other construction" and "Industrial" sand.

Stone.—Both tonnage and value of stone produced increased sharply over that of 1961. Tonnage was 2.2 times and value more than 3 times the 1961 figures. Of total output of stone, Government agencies or their contractors supplied 97 percent of the tonnage and 99 percent of the value, the same percentages in each instance as in 1961. The Alaska Department of Highways was again the leading stone producer, with 58 percent of total tonnage and 61 percent of total value. The U.S. Army Corps of Engineers and the U.S. Naval Station at Adak supplied the bulk of the remaining tonnage and value. The Alaska Railroad, owned and operated by the Federal Government, was the only stone producer classified as commercial. Railroad figures were classified as commercial to make stone figures for Alaska comparable with those of other States.

REVIEW BY REGIONS

With crude oil from the Swanson River field supplying by far the greatest part of value, the Kenai Peninsula was again the leading mineral-producing region in the State. The Yukon River region, with placer gold from dredging and coal from the Nenana field, ranked second. Cook Inlet-Susitna, with coal from the Matanuska field and sand and gravel, was in third place. Seward Peninsula ranked fourth. Gold, sand and gravel, and a small quantity of silver were the only mineral commodities produced.

Kuskokwim River, the only region where metals dominated, had platinum-group metals, mercury, and gold as the leading mineral commodities. The region was fifth in value of mineral production. There was no mineral production from the Bering Sea region.

Alaska Peninsula.—The U.S. Department of the Interior awarded Gulf Oil Corp. a 5-year development contract for oil and gas on 592,000 acres at Port Moller in the central part of the region in Bristol Bay. Terms called for at least three exploration wells and expenditures of not less than $1 million over the 5-year period.

At Wide Bay on the east coast of the Peninsula off the south end of Kodiak Island, Richfield Oil Corp. was drilling an offshore wildcat well from a piling platform. The drilling platform was serviced by a piling causeway 0.5 mile long. At yearend drilling had reached 1,215 feet.

TABLE 20.—Value of mineral production in Alaska, by regions[1]

(Thousand dollars)

Region	1961	1962	Minerals produced in 1962 in order of value
Alaska Peninsula	$29		
Aleutian Islands[1]	63	$868	Sand and gravel, stone.
Bristol Bay	34	53	Sand and gravel.
Cook Inlet-Susitna	4,217	5,601	Coal, sand and gravel, stone, gold, silver.
Copper River	424	194	Sand and gravel, stone, gold, silver.
Kenai Peninsula	[2] 17,809	31,783	Petroleum, natural gas, stone, sand and gravel, gold, silver.
Kodiak Island	1	85	Sand and gravel.
Kuskokwim River	2,203	1,773	Platinum-group metals, mercury, gold, sand and gravel, silver, gem stones.
Northern Alaska	28	148	Natural gas.
Northwestern Alaska	30	20	Gold, gem stones, silver.
Seward Peninsula	1,640	1,828	Gold, sand and gravel, silver.
Southeastern Alaska	737	1,128	Uranium, stone, sand and gravel, gem stones, gold, silver.
Yukon River	[2] 7,538	10,715	Gold, coal, sand and gravel, stone, silver, peat, gem stones.
Total	[2] 34,753	54,196	

[1] No mineral production from Bering Sea region.
[2] Revised figure.

Gulf Oil Corp. at Port Moller and Mobil Oil Co. at Ugashik had field crews engaged in seismic exploration.

Aleutian Islands.—Stone and sand and gravel were the only mineral commodities produced and their value was small.

Bristol Bay.—Pure Oil Co. relinquished its development contract on 477,000 acres near the mouth of the Nushagak River; no drilling was done. Mobil Oil Co. terminated the Becharof-Egegik contract after two wells proved barren. A small production of sand and gravel was recorded.

Cook Inlet-Susitna.—Coal from the Matanuska field, sand and gravel, and stone were the leading mineral commodities of the region, supplying practically all of the $5.6 million production. Small quantities of gold and silver were produced.

Value of coal production, all from the Matanuska field, increased 18 percent, compared with 1961; tonnage was 37 percent greater. Average value per ton, reflecting continued pressure from natural gas for the military fuel and power market, decreased from $10.82 in 1961 to $9.27. An estimated 71 percent of coal was sold to the military. All coal from the region was strip-mined.

Following completion of exploration work by the Bureau of Mines in the Beluga River coalfield in 1961, Columbia Iron Mining Co. obtained permits on Beluga coal lands covering 10,826 acres, and Utah Development Co., a Utah Construction and Mining Co. subsidiary, received permits on 8,350 acres. Seventeen permits to individuals covered 29,368 acres. Columbia had a field crew at Beluga taking unweathered samples from underground openings for coking tests. The company, a subsidiary of U.S. Steel Corp., held under lease the vast Klukwan magnetic iron deposits (both residual placer and lode) in southeastern Alaska. A Utah Development field crew core drilled the Beluga coalbeds. The company dropped its permits after the close of the 1962 field season.

Mrak Coal Co. contracted with Chugach Electric Association for 140,000 tons of coal to be delivered over a 3-year period. The price was $7 per ton continuing the downward trend in coal prices of the past few years.

Cook Inlet-Susitna dropped to second place among the regions in value of sand and gravel production. Five commercial operations and four Government agencies produced 1.4 million tons valued at $1.7 million. The Alaska Department of Highways was the leading producer.

During exploratory drilling for petroleum, gas discoveries were made at the Beluga River unit (Standard Oil Co. of California) and at the West Foreland unit (Pan American Petroleum Corp.). The Beluga discovery, made as 1962 drew to a close, was considered as a source of gas for repressuring the Swanson River field across Cook Inlet on the Kenai Peninsula. Standard of California was studying the feasibility of a 30-mile marine pipeline under the inlet for transporting Beluga gas. Richfield Oil Corp. and Shell Oil Co. were associated with Standard in the Beluga venture.

Dry holes were drilled at Bell Island (British-American Oil Producing Co.), Chuit-State (Superior Oil Co.), Pittman, near Wasilla (Union Oil Company of California), and Stedatna Creek-State, near Tyonek (Pan American).

Copper River.—Sand and gravel, stone, and a very small quantity of gold and silver comprised the mineral production of the region. Value of production was less than 1 percent of that for the State.

At the Bering River and White River units, both near Yakataga on the Gulf of Alaska, Richfield Oil Corp. drilled dry holes exploring for petroleum. Wildcat wells drilled by Standard of California at the Chaix Hills and Riou Bay units near Icy Bay, also on the gulf, were unsuccessful. Union Oil Company of California's Tazlina wild-

cat, in the Copper River basin south of Lake Louise, also failed to find oil. At yearend, Aledo Oil Co. was drilling below 6,400 feet on the Eureka unit near the old Eureka roadhouse.

Kenai Peninsula.—Petroleum and natural gas again dominated the news of the mineral industry on the peninsula. At yearend, Standard of California, operator of the Swanson River field, had almost completed the development of Swanson River. Standard obtained approval of its plans to repressure Swanson River using gas from upper zones and associated gas to maintain pressure in the Hemlock producing zone. Late in 1962, repressuring was started at two of the Soldatna Creek wells at Swanson River. Plans called for a total of six injection wells and 25 million cubic feet of gas per day when the program was underway; later as much as 75 million cubic feet per day might be required. Gas was compressed to 6,500 pounds per square inch before injection.

Ground-breaking ceremonies for the Standard of California $10 million refinery at Nikiski were held in June. Scheduled for completion in mid-1963, the 20,000-barrel-per-day refinery was to convert Swanson River crude oil to diesel and jet fuels and to heating and fuel oils. No provision was made for the manufacture of gasoline, but expansion to include gasoline was feasible if demand justified it. By yearend, major components of the plant had been delivered and installed.

Developments in natural gas, proceeded at a slower pace than those in oil but were substantial and indicated that Alaska gas resources would make an important contribution to the economy of the State. Anchorage Natural Gas Co. expanded gas service to commercial and residential users in the Greater Anchorage area. Union Oil Co. and Marathon Oil Co. (formerly Ohio Oil Co.) reduced the wellhead price of Kenai unit gas from 32.5 to 25 cents per thousand cubic feet. Anchorage Natural Gas had made no changes in its rates by yearend but adjustments were under study. Perhaps the development of greatest significance to natural gas was the announcement by Union-Marathon that negotiations were underway with Tokyo Gas Co. (Japan) for shipment of liquefied natural gas from the Kenai unit. Many factors were still unresolved, but the technical problems of moving the gas were said to be solved. Union-Marathon was basing the negotiations on tanker deliveries at a rate that would provide at least 35 million cubic feet per day. Kenai unit reserves, estimated at more than 1 trillion cubic feet, were ample to handle both the proposed export and the Anchorage market, which required 5 million cubic feet per day.

There was little activity in other sectors of the mineral industry in the region. Small quantities of stone, sand and gravel, gold, and silver were produced.

Kodiak.—The U.S. Navy reported a small quantity of sand and gravel from Kodiak. This was the only mineral output.

Kuskokwim River.—Metals constituted more than 99 percent of the of the value of mineral output, and the region ranked fifth in the State. Platinum-group metals, mercury, and gold composed almost the entire output; a small quantity of byproduct silver from gold and platinum placer operations, gem stones, and sand and gravel were the only other mineral commodities of record.

Goodnews Bay Mining Co. continued platinum-dredging operations south of Platinum. Operations and results were slightly lower than in 1961. The company was considering mining a section of deep channel—under 170 feet of overburden—by dredging or by drift mining. For a dredging operation, a boat capable of digging 100 feet underwater and carrying a 30-foot bank, with 40 feet of overburden being stripped, would be suitable. Goodnews Bay was the only producer of platinum as the primary product in the Nation. Under the new State offshore-mining regulations, Fremont Mining Co. conducted geophysical surveys of offshore placers at Goodnews Bay. Additional work was planned for the 1963 field season.

For the second consecutive year, production of mercury decreased in physical volume and in value. The Red Devil mine of Alaska Mines and Minerals, Inc., in the Aniak district, again supplied almost all of the mercury output in the State. The only other production of record was from the Alice and Bessie mine (formerly the Parks), also in the Aniak district. Output from these two properties placed Alaska third among the mercury-producing States of the Nation, with 14 percent of the national total.

Late in 1962, OME announced execution of an exploration assistance contract with Alaska Mines and Minerals, Inc., for work on a deposit in the Georgetown district. The contract was for $324,100, of which the Government was to pay one-half, as the work proceeded, up to a maximum of $162,050. Repayment of Government funds was to be on a royalty basis from ore found by the exploration work. If no ore was found, the Government participation was to be canceled with no further liability by the mine operator. Under a previous Defense Minerals Exploration Administration (predecessor of OME) loan, Alaska Mines and Minerals received $152,742 in Government funds for exploration work. The entire sum was repaid from royalties on ore found. The new loan was the largest executed by OME up to that time. In December, Alaska Mines and Minerals stopped all production work and was strictly on an exploration basis.

New York-Alaska Gold Dredging Corp. continued dredging at Nyac in the western Kuskokwim River region. Only one dredge, a 6-cubic-foot unit, was used. Severe winter temperatures froze much of the ground to bedrock and thus delayed startup in the spring. In spite of the delay, results were approximately the same as in 1961.

Northern Alaska.—The region had no appreciable mineral output. There was no recorded production from the Meade River coalfield near Barrow. Gas wells on Naval Petroleum Reserve No. 4 supplied 197 million cubic feet of natural gas valued at $148,000. It was used at Government agencies in Barrow and at the Puget Sound and Drake powerplants. Late in 1962, the President signed a bill authorizing the Navy to drill a well in the South Barrow gas field to provide gas for sale to residents of Barrow. Cost of the well was estimated at $400,000, and an additional $450,000 would be required for a distribution system.

There was no exploratory drilling for petroleum in the region in 1962, but interest in the oil potential of the Arctic Slope remained active. Field parties spent 12 crew-months in surface geological exploration.

Recognizing strong opposition from natives in the Cape Thompson area, the AEC deferred further work on Project Chariot, the proposed construction by nuclear explosives of an artificial harbor on the Chukchi Sea. The Commission stressed that the project was deferred but not abandoned.

Coal deposits along the Kukpowruk River were examined by the Bureau of Mines and samples were obtained for coking tests. Further fieldwork was scheduled for the 1963 season.

Northwestern Alaska.—Gem stones, gold, and silver were the only mineral commodities produced. Total value was only a fraction of 1 percent of the mineral output of the State.

At the Ruby Creek copper deposit near Kobuk in the Shungnak district, and north of the Arctic Circle, Bear Creek Mining Co., a Kennecott Copper Corp. exploration subsidiary, continued the examination work begun in 1957. Bear Creek had a 40-man crew on diamond drilling and geological work in the 1962 season. No reports of results were released.

Seward Peninsula.—Gold was again the leading mineral commodity of the region, with sand and gravel in second place. A small quantity of silver, which was a byproduct metal from gold placer operations, was the only other mineral commodity recorded.

U.S. Smelting, Refining & Mining Co. (USSR&M) operated two large dredges at Nome and, as in the past, was the leading gold producer. USSR&M shut down one dredge in August and the other at the end of the season. The company announced the permanent stoppage of dredging operations until economic conditions became favorable to the gold-mining industry again. Other gold-dredging operations on the peninsula included Nugget Mining Co. (Ninkluk River, Council district), Inmachuk Mining Co. (Inmachuk River, Fairhaven district), Martinson Brothers (Kougarok River, Kougarok district), Engstrom & Son Dredging Co. (Basin Creek, Nome district), and Lee Bros. Dredging Co. (Solomon River, Nome district).

Interest in the beryllium resources of the Seward Peninsula was stimulated by the announcement of two new discoveries by the Geological Survey. Beryllium occurring as chrysoberyl in veinlets in argillaceous limestone was reported on the east side of Rapid River, a tributary of Lost River. The area is 100 miles northwest of Nome. A second discovery, with occurrences along a 6-mile zone on both sides of Lost River near the Lost River tin mine, was also reported. The Bureau of Mines continued examinations of tin and beryllium deposits on the peninsula.

Southeastern Alaska.—Uranium ore, stone, sand and gravel, and a small quantity of gem stones and gold and silver made up the mineral output of the region. Southeastern Alaska ranked sixth among the regions of the State.

At the Ross-Adams deposit, Bokan Mountain, Prince of Wales Island, Bay West, Inc., of Moab, Utah, mined and shipped uranium ore to Lakeview, Oreg. The company received an upward revision in its uranium oxide (U_3O_8) allotment during 1962. Shipments were expected to continue over the next several years under the new allotment.

Under provisions of the State offshore mineral leasing bill, prospecting permits were granted on 5,120 acres in Stephens Passage south of Grand Island. The permittee planned an extensive sampling program of the bottom deposits before attempting an operation. Gold, from the natural erosion of deposits in the Juneau gold belt, was the material of chief interest.

Columbia Iron Mining Co. had exploration crews active at Union Bay (iron) and on Heceta and Wadleigh Islands (limestone). Utah Construction & Mining Co. continued examination of the Mount Andrew deposit (copper-iron) on Kasaan Peninsula, Prince of Wales Island. Newmont Exploration Co. had a drilling crew on the Brady Glacier property (nickel-copper). Sinclair Oil & Gas Co. filed on 64 claims on Heceta Island; the interest was thought to be limestone. The Bureau of Mines reopened old workings at the Gypsum Camel mine (gypsum) and did some underground drilling. Further work was planned for the 1963 field season. The Bureau also made reconnaissance surveys and field examinations of copper, copper-zinc, and copper-iron deposits. Some preliminary geophysical work was done on the Jingle Jangle copper-zinc deposit at Tracy Arm.

Yukon River.—Gold, coal, sand and gravel, and stone were the leading mineral commodities. The region ranked second to the oil-producing Kenai Peninsula. Output of gold increased sharply as a result of higher unit values in some of the placer operations, but no particular significance was attached to the increase. With the announcement that the USSR&M operations in the Fairbanks district were to be terminated at the close of the 1963 season, gold output of the region was expected to decrease markedly.

USSR&M operated two dredges in the Fairbanks field, one at Chicken and one on the Hogatza River. Others dredging included Mathews Mining Co. (Woodchopper Creek), Glen Associates (Otter and Flat Creeks), Otter Dredging Co. (Otter Creek), and Minalaska, Inc. (Gaines Creek).

Output of lode gold was minor. Little Squaw Mining Co., under an OME loan, was active in the Chandalar district, north of the Arctic Circle. The company proceeded with road building, surface exploration, trenching, and underground exploration.

Tonnage of coal from the region increased 10 percent over that of 1961, but value was only 3 percent higher. Value per ton of all coal, both strip and underground, was $6.30, compared with $6.70 in 1961. Late in 1962, Usibelli Coal Mine, Inc., shut down the Suntrana underground mine at Healy River. Suntrana was the last major underground coal mine to operate in the State.

The U.S. Army Corps of Engineers continued investigations of the Rampart Dam project, the huge hydroelectric installation proposed on the Yukon River, 85 miles northwest of Fairbanks. Additional core drilling of the damsite was done, and a preliminary design for a concrete gravity dam was underway at yearend. Development and Resources Corp. of New York, under a contract with the corps, reported on the market for Rampart power if the project was built. The Bureau of Mines made a preliminary investigation of the mineral resources of the reservoir site and surrounding area, and a report for the Corps of Engineers was in process as the year ended.

The Mineral Industry of Arizona

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Arizona Bureau of Mines for collecting information on all minerals except fuels.

By L. P. Larson [1]

MINERAL production in Arizona totaled $474.1 million—an increase of $48.1 million (11 percent) over that of 1961. Metals accounted for 90 percent of the total value; nonmetals 10 percent; and mineral fuels less than 1 percent. Increased output of copper accounted for most of the increase in value. The value of metals production increased $44.6 million primarily because of the first full year of operation of the Mission Unit by American Smelting and Refining Co. (Asarco). Output of copper from the newly installed leach-precipitation facilities at Esperanza, operated by Duval Sulphur & Potash Co., also contributed to the increase. The value of silver, lead, and zinc output increased; lower values were reported for gold, mercury, molybdenum, and uranium ore. Production and value of uranium ore in 1962 were markedly less than in the previous year primarily because of the temporary closing of the Orphan mine in Coconino County caused by the collapse of the ore bin and headframe in December 1961. Although improved metallurgical processing resulted in higher mill recovery of the molybdenum contained in the ore, the State molybdenum production was down slightly from 1961 because lower grade ores were treated.

Sand and gravel output was ranked second in value of mineral commodities produced in the State and accounted for 38 percent of the value of all nonmetals produced and 4 percent of the State total value of mineral output. Cement output approximated the 1961 production.

Expansions of certain open-pit mines located in the Twin Buttes mining district in the Sierrita Mountains of southern Arizona were planned by Banner Mining Co. and Pima Mining Co., adjoining Asarco Mission Unit, and by Duval Sulphur & Potash Co. at its property 8 miles to the south.

Employment and Injuries.—Final data for 1961 and preliminary data for 1962 compiled by the Bureau of Mines for employment and injuries in the Arizona mineral industries, excluding all mineral fuels except coal, are shown in table 2.

[1] Physical scientist, Bureau of Mines, Denver, Colo.

Legislation and Government Programs.—The Office of Minerals Exploration (OME) executed its first contract in Arizona to assist the Cerbat Mining and Milling Co. of Kingman in exploring for silver, lead, and zinc in Mohave County. Total cost of the work was estimated at $49,920 of which the Government participation was to be $24,960.

Under the Defense Minerals Exploration Administration (DMEA), which preceded OME, 36 contracts were executed authorizing exploration work in Arizona costing $1,734,000, toward which the Government paid $600,840 for work completed. Discoveries were certified under 18 of the contracts, and royalties paid to the Government on production from Arizona properties totaled $139,196 by March 31, 1962.

The Bureau of Land Management received patent applications for 33 claims, totaling nearly 5,000 acres of gold placer claims in Maricopa County, from Alaska International Corp.; The Silverton Mining and Milling Co., Inc., and the Arizona Placer Mining Co., Inc. The three companies held patents on approximately 8,000 acres in the area.

TABLE 1.—Mineral production in Arizona[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Beryllium concentrate—short tons, gross weight	8	$4	1	(2)
Clays[3]—thousand short tons	165	240	139	$184
Copper (recoverable content of ores, etc.)—short tons	587,053	352,232	644,242	396,853
Gem stones	(4)	119	(4)	120
Gold (recoverable content of ores, etc.)—troy ounces	145,959	5,109	137,207	4,802
Iron ore (usable)—long tons, gross weight	246	(5)	(5)	(5)
Lead (recoverable content of ores, etc.)—short tons	5,937	1,223	6,966	1,282
Lime—thousand short tons	167	2,686	174	2,914
Mercury—76-pound flasks	148	29	(5)	(5)
Molybdenum (content of concentrate)—thousand pounds	4,878	6,232	4,412	5,864
Natural gas—million cubic feet			230	27
Petroleum (crude)—thousand 42-gallon barrels	[6] 73	(5)	[7] 43	(5)
Pumice—thousand short tons	745	1,893	756	1,640
Sand and gravel—do	[6] 17,688	[6] 16,175	15,579	17,404
Silver (recoverable content of ores, etc.)—thousand troy ounces	5,120	4,733	5,454	5,917
Stone—thousand short tons	3,582	4,626	4,333	6,616
Tungsten ore and concentrate (60-percent WO_3 basis)—short tons			15	14
Uranium ore—do	228,225	4,965	143,196	3,047
Vanadium—do	(5)	(5)	632	(5)
Zinc (recoverable content of ores, etc.)—do	29,585	6,804	32,888	7,564
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite and fire clay), diatomite, feldspar, gypsum, helium, manganese ore and concentrate (1961), mica (scrap), perlite, pyrites, and values indicated by footnote 5		[6] 18,925		19,894
Total		[6] 425,995		474,142

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Less than $500.
[3] Excludes bentonite and fire clay; included with "Value of items that cannot be disclosed."
[4] Weight not recorded.
[5] Figure withheld to avoid disclosing individual company confidential data.
[6] Revised figure.
[7] Preliminary figure.

TABLE 2.—Employment and injuries in the mineral industries[1]

Industry	Number of operations	Average number of men employed	Total man-hours worked	Injuries		Frequency rate (injuries per million man-hours)
				Fatal	Non-fatal	
1961:						
Copper mines and mills	135	9,517	22,971,443	7	477	21.1
Copper smelters and refinery	9	1,950	5,155,948	1	136	26.6
Uranium mines and mills	30	331	677,621	--	44	64.9
Other metal mines and mills	86	518	784,790	--	107	136.3
Nonmetal mines and mills (other than sand and gravel and stone)	46	186	321,850	--	13	40.4
Stone quarries and plants	70	559	1,133,258	--	20	17.6
Sand and gravel plants	143	1,685	3,116,120	--	68	21.8
Coal mines	1	4	3,200	--	--	--
Total	520	14,750	34,164,230	8	865	25.6
1962:[2]						
Copper mines and mills	93	9,223	23,060,328	9	579	25.5
Copper smelters and refinery	9	1,840	4,600,803	--	114	24.8
Uranium mines and mills	24	282	502,590	--	23	45.8
Other metal mines and mills	71	412	742,067	1	97	132.1
Nonmetal mines and mills (other than sand and gravel and stone)	32	247	476,260	--	6	12.6
Stone quarries and plants	79	595	1,253,396	--	14	11.2
Sand and gravel plants	86	1,221	2,380,209	--	58	24.4
Coal mines	1	4	3,200	--	--	--
Total	395	13,824	33,018,853	10	891	27.3

[1] Excludes employees in all mineral fuels industries except the coal industry, as well as officeworkers.
[2] Preliminary figures.

Sand and gravel and stone were used by contractors of the Bureau of Public Roads, Arizona State Highway Department, and county highway departments in the constructing of interstate, State, and county highways throughout the State. A report[2] showed that from July 1956 to January 1, 1963, Arizona completed, to full or acceptable standards, 275.7 miles of road, plus 265.7 miles of highway improved to standards adequate for present travel (a total of 541.4 miles open to traffic). Work in progress with interstate funds included 48 miles under construction and 288.3 miles in engineering or right-of-way status, a total of 336.3 miles. In mileage completed, Arizona was ranked 8th in the Nation; in total underway, it was ranked 17th. The Arizona State highway contracting program[3] in 1962 included $2.5 million in State financed roads, $15 million under the Federal-Aid Primary and Secondary (ABC), and $42.5 million in interstate highway contracts for a total of $60 million. Planned for 1963 were $2.5 million in State financed roads, $13 million in ABC contracts, and $42.5 million in contracts for interstate roads, a total of $58 million, which represented a decrease of 13 percent ($2 million) in ABC contracts, for an overall reduction of 3 percent in outlay for road construction in 1963.

[2] Bureau of Public Roads. Quarterly Report on the Federal-Aid Highway Program, Dec. 31, 1962. Press Release BPR 63-10, Feb. 10. 1963.
[3] Engineering News-Record. Road Contractors Will Set a Record. V. 170, No. 16, Apr. 18, 1963, pp. 21–24.

REVIEW BY MINERAL COMMODITIES

METALS

Copper.—Arizona continued to lead the Nation in mine production of copper, contributing 52 percent to the U.S. total. Copper output from mines in the State increased 10 percent to 644,242 tons and represented 93 percent ($396.9 million) of the total value of metals output and 84 percent of all minerals produced. Production declined from 53,000 tons in January to 52,000 tons in February, rose to 56,000 tons in March and April, and increased to 60,000 tons in May for the 1962 high. By the end of June, production had declined to 54,000 tons. Beginning in July, output was cut back 5 to 10 percent to maintain world stocks at safe levels. Implementing this decision, Phelps Dodge Corp. in July, and again in September, voluntarily reduced production by 5 percent. The cutbacks lowered company production to slightly less than 90 percent of rated capacity, the monthly curtailment averaging 2,350 short tons. Inspiration Consolidated Copper Co. curtailed production by 9 percent or 400 tons per month. Curtailment, according to the company annual report, reduced the tonnage of ore mined at the Thornton and Live Oaks pits from 16,500 to 15,000 tons per day. Arizona primary output totaled 331,121 tons for the first six months, and was reduced 5 percent to 313,121 tons during the second six months.

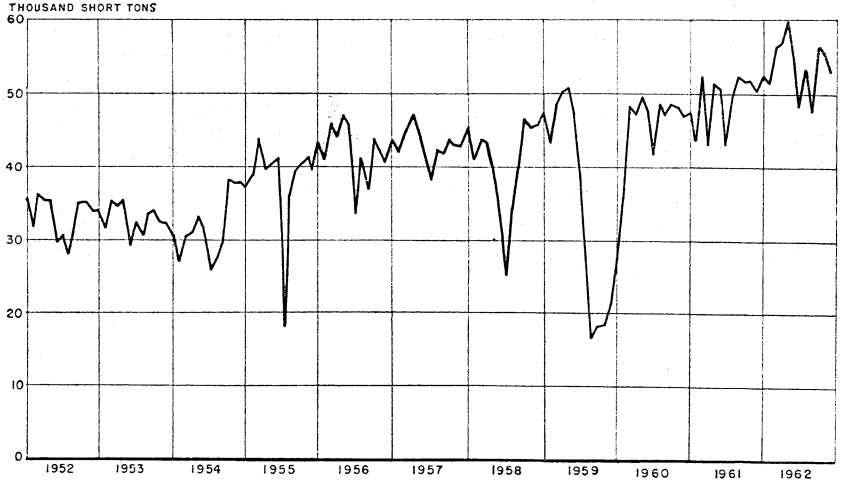

FIGURE 1.—Mine production of copper in Arizona, 1952–62, by months, in terms of recoverable metal.

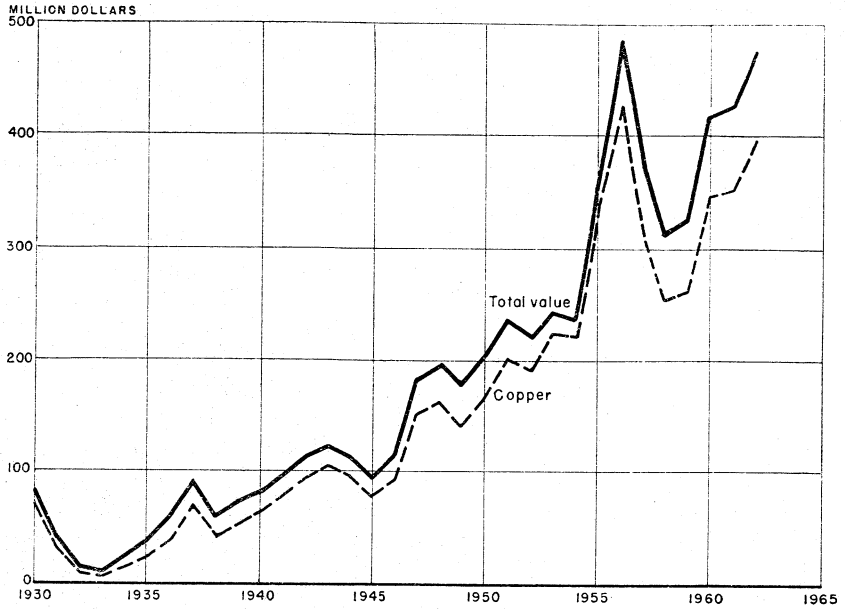

FIGURE 2.—Value of mine production of copper and total value of mineral production in Arizona, 1930–62.

TABLE 3.—Fifteen leading copper-producing mines in 1962, in order of output

Rank in 1962	Rank in 1961	Mine	District	County	Operator	Source of copper in 1962
1	1	Morenci	Copper Mountain.	Greenlee	Phelps Dodge Corp.	Gold-silver ore, copper ore, copper precipitates.
2	2	San Manuel	Old Hat	Pinal	Magma Copper Co., San Manuel Div.	Copper ore.
3	4	Lavender pit, Copper Queen.	Warren	Cochise	Phelps Dodge Corp.	Copper ore, copper precipitates.
4	3	New Cornelia	Ajo	Pima	do	Gold-silver ore, gold tailings, copper ore.
5	5	Ray pit	Mineral Creek	Pinal	Kennecott Copper Corp.	Copper ore, copper precipitates.
6	6	Inspiration	Globe-Miami	Gila	Inspiration Consolidated Copper Co.	Do.
7	12	Mission	Pima	Pima	American Smelting and Refining Co.	Copper ore.
8	7	Esperanza	do	do	Duval Sulphur & Potash Co.	Copper ore, copper precipitates.
9	8	Silver Bell	Silver Bell	do	American Smelting and Refining Co.	Do.
10	10	Copper Cities	Globe-Miami	Gila	Tennessee Corp., Miami Copper Co. Div.	Copper ore.
11	11	Pima	Pima	Pima	Pima Mining Co.	Do.
12	9	Magma	Pioneer	Pinal	Magma Copper Co.	Gold-silver ore, copper ore.
13	13	Bagdad	Eureka	Yavapai	Bagdad Copper Corp.	Copper ore, copper precipitates.
14	14	Miami	Globe-Miami	Gila	Tennessee Corp., Miami Copper Co. Div.	Copper precipitates.
15	15	Palo Verde	Pima	Pima	Banner Mining Co.	Copper ore.

TABLE 4.—Ore mined, waste and leach material removed, and total copper production at principal copper open-pit and underground mines

(Short tons)

Mine	Ore mined		Waste and leach material removed		Total copper produced from all sources [1]	
	1961	1962	1961	1962	1961	1962
Open pit:						
Morenci	16,286,000	16,983,000	27,174,000	26,539,000	111,443	121,302
New Cornelia	9,358,000	9,648,000	14,692,000	14,892,000	70,334	71,008
Ray	7,428,104	7,695,757	[2] 15,491,623	[2] 15,070,961	64,361	66,475
Inspiration	4,847,164	5,552,219	3,447,947	3,932,641	39,165	52,291
Lavender	4,928,000	5,374,000	13,647,000	14,064,000	39,585	41,784
Mission [2]	2,198,585	6,278,000	23,570,700	23,810,200	(3)	(3)
Esperanza [2]	4,264,890	4,245,504	6,352,396	5,926,620	(3)	(3)
Silver Bell [2]	2,686,800	2,760,600	978,670	2,799,850	(3)	(3)
Copper Cities	[2] 3,137,253	[2] 3,150,952	[2] 1,562,927	[2] 2,027,321	[5] 17,336	[5] 17,437
Pima	[2] 1,398,367	[2] 1,181,654	[2] [4] 5,361,053	[2] 4,963,059	(3)	(3)
Bagdad	[2] 1,807,260	[2] 1,090,992	[2] 7,174,631	[2] 8,215,214	[6] 10,970	[6] 14,248
Underground:						
San Manuel	12,529,243	12,565,545			82,612	84,208
Copper Queen	595,000	618,000			30,398	30,742
Magma	410,958	337,618			20,761	14,913
Miami	(7)	(7)			[8] 9,429	[8] 9,201
Palo Verde	158,546	243,072			(3)	(3)

[1] Includes copper recovered from leaching of material in place and in dumps.
[2] Mining World Catalog, Survey and Directory, Apr. 25, 1963, p. 93.
[3] Figure withheld to avoid disclosing company confidential data.
[4] Cubic yards.
[5] Gross metal in concentrate shipped.
[6] Gross metal in concentrate and precipitates shipped.
[7] All production from in-place leaching.
[8] Gross metal in precipitates shipped.

Source: Company-published annual reports except where otherwise specified.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1953–57 (average)	167	6	52,616	130,762	$4,576	4,749	$4,298
1958	100	4	56,773	142,979	5,004	4,685	4,240
1959	101	3	53,732	124,627	4,362	3,898	3,528
1960	106	5	66,800	143,064	5,007	4,775	4,322
1961	96	4	72,537	145,959	5,109	5,120	4,733
1962	83	5	79,583	137,207	4,802	5,454	5,917
1860–1962	(3)	(3)	(3)	12,876,904	338,187	369,888	288,215

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	449,464	$305,638	10,414	$3,004	26,232	$6,284	$323,800
1958	485,839	255,551	11,890	2,782	28,532	5,821	273,398
1959	430,297	264,202	9,999	2,300	37,325	8,585	282,977
1960	538,605	345,784	8,495	1,988	35,811	9,239	366,340
1961	587,053	352,232	5,937	1,223	29,585	6,804	370,101
1962	644,242	396,853	6,966	1,282	32,888	7,564	416,418
1860–1962	18,426,686	7,470,734	621,744	120,955	913,173	220,166	8,438,257

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old tailings, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Data not available.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1962, by counties, in terms of recoverable metals

County	Mines producing [1]		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
Cochise	5	----------	6,056,766	46,669	$1,633,415	876,474	$950,974
Coconino	1	----------	10,000	----------	----------	1,930	2,094
Gila	11	----------	8,793,727	1,849	64,715	175,433	190,345
Greenlee	1	----------	16,983,181	11,467	401,345	589,012	639,078
Maricopa	2	----------	8	6	210	4	4
Mohave	5	1	2,726	354	12,390	7,803	8,466
Navajo	----------	----------	[3]	----------	----------	3,727	4,044
Pima	14	----------	24,602,573	32,868	1,150,380	2,016,260	2,187,642
Pinal	18	----------	20,674,225	25,586	895,510	901,107	977,701
Santa Cruz	7	----------	19,971	24	840	52,383	56,836
Yavapai	13	----------	2,385,411	18,326	641,410	829,359	899,855
Yuma	6	4	138	58	2,030	93	101
Total:							
1962	83	5	79,528,726	137,207	4,802,245	5,453,585	5,917,140
1961	96	4	72,537,174	145,959	5,108,565	5,120,007	4,733,395

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Cochise	73,860	$45,497,606	4	$800	2,831	$651,199	$48,733,994
Coconino	62	37,945	----------	----------	----------	----------	40,039
Gila	82,681	50,931,373	21	3,846	[4]	12	51,190,291
Greenlee	121,302	74,722,032	----------	----------	----------	----------	75,762,455
Maricopa	----------	----------	----------	----------	----------	----------	214
Mohave	34	20,975	27	5,042	6	1,391	48,264
Navajo	317	195,303	----------	----------	2	380	199,727
Pima	179,814	110,765,886	52	9,485	2,804	644,908	114,758,301
Pinal	167,333	103,077,313	16	2,880	[4]	34	104,953,438
Santa Cruz	38	23,500	914	168,120	1,205	277,058	526,354
Yavapai	18,759	11,555,421	5,928	1,090,881	26,040	5,989,235	20,176,802
Yuma	42	25,718	4	690	[4]	23	28,562
Total:							
1962	644,242	396,853,072	6,966	1,281,744	32,888	7,564,240	416,418,441
1961	587,053	352,231,800	5,937	1,223,022	29,585	6,804,550	370,101,332

[1] Operations at miscellaneous cleanups not counted as a producing mine.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Byproduct of uranium ore.
[4] Less than 0.5 ton.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source materials in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	5	1,725	75	328	51,700		
Dry gold-silver	6	107,082	338	8,502	1,742,600		
Dry silver	13	31,565	1	10,999	261,300		
Total	24	140,372	414	19,829	2,055,600		
Copper	41	78,868,147	117,362	4,571,370	1,200,945,700	1,200	577,900
Copper-lead-zinc	1	900	287	6,798	9,800	54,800	12,100
Copper-zinc	3	173,766	138	56,475	10,472,700	28,700	22,129,800
Lead	7	2,231	32	7,388	14,500	237,100	27,500
Lead-zinc	4	290,733	17,954	760,351	810,000	13,512,300	37,994,900
Zinc	1	19,435	6	9,882	42,700	97,900	5,030,500
Total	56	79,355,262	135,779	5,412,264	1,212,295,400	13,932,000	65,772,700
Other "lode" material:							
Gold tailings and gold-silver tailings	2	22,706	931	15,449	56,700		
Copper cleanup	(2)	386	25	382	103,100		
Copper precipitates	12	54,127			73,215,900		
Copper tailings	1	10,000		1,930	123,200		
Uranium ore				3,727	634,100		3,300
Total	15	87,219	956	21,488	74,133,000		3,300
Total "lode" material	83	79,582,853	137,149	5,453,581	1,288,484,000	13,932,000	65,776,000
Placer	5		58	4			
Total all sources	88	79,582,853	137,207	5,453,585	1,288,484,000	13,932,000	65,776,000

[1] Detail will not necessarily add to totals because some mines produce more than one class of material.
[2] From properties not classed as mines.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1962, by types of material processed and methods of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Cyanidation: Ore	31	265			
Concentration and smelting of concentrates:					
Ore [1]	117,268	4,979,177	[2] 1,177,778,500	13,822,000	65,756,400
Old tailings		1,930	123,200		
Total	117,268	4,981,107	1,177,901,700	13,822,000	65,756,400
Direct-smelting:					
Ore	18,894	456,378	37,206,600	110,000	19,600
Cleanings	25	382	103,100		
Copper precipitates			73,215,900		
Old tailings	931	15,449	56,700		
Total	19,850	472,209	110,582,300	110,000	19,600
Placer	58	4			
Grand total	137,207	5,453,585	1,288,484,000	13,932,000	65,776,000

[1] Includes uranium ore concentrate.
[2] Includes copper recovered from leaching of ore at one operation that employs dual-process treatment of leaching followed by flotation concentration; combined to avoid disclosing individual company confidential data.

Production during the second 6 months, reported to the Bureau, was as follows: In July, owing to vacations, production totaled 48,149 tons, 12 percent below that of June. By August, production had risen to 53,193, dropping in September to 47,390 tons, the lowest output of 1962. It was 56,147 tons in October, 55,331 tons in November, and 52,911 tons in December, a monthly average of 54,796 tons during the last quarter.

Five leading copper producers furnished 416,754 tons, or 65 percent of the State total; and the 15 major producers accounted for 628,307 tons, or 98 percent, of the total copper output. Among the five leading mines, Phelps Dodge Corp. operated three, supplying 41 percent of the total copper output; San Manuel Division, Magma Copper Co., and Ray Mines Division, Kennecott Copper Corp., each operated one.

Asarco reportedly had prospect-drilled replacement copper ore bodies located in the contact zone northeast of the El Tiro pit, near Silver Bell. Sufficient ore had been found to justify expanding the pit in that direction, according to the company.

Banner Mining Co. awarded a contract to Stearns-Roger Manufacturing Co. to erect a 5-ton-per-day pilot plant for recovering copper from low-grade copper oxide-lime ores. The plant was near the company 1,000-ton-per-day concentrator at Mineral Hill in the Pima mining district, 20 miles south of Tucson. Exploration was continued in the Helvetia area, 25 miles southeast of the Palo Verde mine. According to the company, drilling indicated the presence of copper mineralization. Metallurgical testing of samples from the property was conducted to determine whether commercial exploitation was warranted.

Production continued throughout 1962 at the Atlas mine and mill of BS & K Mining Co. in the Silver Bell mining district, Pima County. Since completing its shaft to a depth of 554 feet in August 1961, the company established four levels and completed 1,200 feet of drifting.

D.M.B.D. Mining Co., Inc., finished constructing a 60-ton selective flotation mill at the Childs-Aldwinkle mine near Mammoth.

Duval Sulphur & Potash Co. completed installing leach-precipitation facilities at its Esperanza open-pit copper mine, 33 miles southwest of Tucson in the Pima mining district. The new facilities were designed to handle 1,000 gallons per minute of pregnant copper solution from the leaching of dumps that contained sub-milling copper values and that were segregated for this purpose during the stripping and mining operations. Production from the leach dumps was to supplement the company output of copper from its 12,000-ton-per-day concentrator. Plant-scale testing of an autogenous grinding circuit for metallic ores was in progress at the Esperanza mill during the second half of 1962. The test results demonstrated that autogenous grinding was feasible for certain Arizona porphyry ores.

Duval Sulphur & Potash Co. announced plans to develop and place in production its Mineral Park copper-molybdenum property 15 miles northwest of Kingman. Plans for developing this property included removing 23 million tons of overburden and erecting a 12,000-ton-per-day concentrator. Ore from the new mine was to be processed to

recover copper and molybdenum concentrates. The copper concentrate was to be shipped to a custom smelter; the molybdenum concentrate was to be marketed by the company to the metal trades. Cost of completing the project was estimated at $28 million. Design and construction work began late in 1962. Production was scheduled to begin late in 1964.

Inspiration Consolidated Copper Co. began mining at the Christmas mine in August, after completing the 1,600-foot level, which connected the main ore body with the McDonald shaft, and after installing haulage equipment. At full production, the mine was expected to produce 5,600 tons of ore per day on a 5-day-week basis.

The company equipped a large dump for leaching copper at the Inspiration mine. First solutions were placed in December. The new area was to replace old leaching sites that showed signs of exhaustion. Plans were made to strip a low-grade ore deposit in the Thornton pit. Mining equipment was ordered and development started. Investigations were being made on the feasibility of increasing plant capacity at Inspiration to 20,000 tons of ore per day to treat the additional reserves of low-grade ore in the Thornton pit and in the separate Red Hill mine.

Kennecott Copper Corp. completed the planned workings at its new development shaft at the Safford project claims northeast of Safford. Leach testing in the new pilot plant near the shaft was completed and the pilot plant closed. Additional leach testing was conducted in the company Utah laboratory. Exploration and development work continued throughout 1962.

Mine production was resumed at the Magma mine near Superior in February after a 2-month shutdown caused by a fire, which broke out December 2, 1961.[4] The fire started in an abandoned stope on the 2,900-foot level in a part of the east replacement area. The fire was confined between the 2,900- and 3,100-foot levels by placing 4-foot concrete bulkheads in all openings leading to the area. Presumably, the fire was caused by spontaneous combustion of splintered and crushed mine timbers.

Beds of the east replacement area of the Magma mine supplied the bulk of the ore produced, although some minor production came from veins in the central division. The rest of the ore was taken from the vein-type body in the western part of the property.

Miami Copper Co. Division, Tennessee Corp., developed an area on the west side of the Copper Cities pit near Miami to reduce the pit slope and increase the ore reserves.

McFarland & Hullinger produced ore from the Johnson Camp mine owned by Cyprus Mines Corp. The company employed 30 men underground and 16 men on the surface and in the 220-ton flotation plant. The zinc concentrate produced was shipped to the National Zinc Co., Inc., smelter in Bartlesville, Okla.; the copper concentrate was shipped to the Inspiration Consolidated Copper Co. smelter at Inspiration and the Asarco smelter in El Paso, Tex.

[4] Short, Bruce. Magma Mine Fire. Min. Cong. J., v. 48, No. 9, September 1962, pp. 42–45.
Mining World. How the Recent Magma Fire Was Brought Under Control. V. 24, No. 6, May 1962, pp. 20–24.

Newmont Mining Co. acquired 81 percent ownership of Magma Copper Co. through the exchange of stock. Newmont issued three-quarters of a share of new 4-percent cumulative preferred stock of $100 par value for each Magma share deposited before the deadline date. Newmont previously owned 285,961 shares or 22 percent of Magma Copper Co. Magma was maintained as a separate operating subsidiary.

Phelps Dodge Corp. filed an application with the Federal Power Commission for a license to build a hydroelectric plant in Coconino and Gila Counties. The project called for a 160-foot concrete arch dam (creating a reservoir having a gross capacity of 15,000 acre-ft), a powerhouse with an installed capacity of 2,800 kilowatts, water conduits, and transmission lines. Total cost was estimated at $6.7 million.

According to Phelps Dodge Corp. annual report, underground exploration work was continued at the Copper Queen mine throughout 1962. No new ore bodies were discovered, but the tonnage of new ore developed virtually equaled the tonnage of ore mined. The shaft serving the Campbell area was deepened an additional 372 feet during the year to a total depth of 3,332 feet.

The 25-ton-per-day sponge-iron plant, installed at the Douglas smelter in 1961, was operated most of 1962. Results were satisfactory, and plans to double plant capacity were announced. This plant made sponge iron from the iron oxides produced in the smelting process. The sponge iron was being produced for use as a precipitant of copper from dump leaching solutions at Bisbee.

Pima Mining Co. proceeded with the expansion of the Pima mill south of Tucson from 3,800 to 7,000 tons of ore per day. This expansion, to be completed by October 1963 would permit the company to treat an additional 18 million tons of proved ore averaging 0.66 percent copper. Besides mining and milling company ore, Pima continued to mine and mill Banner Mining Co. ore (Daisy mine) from the Pima pit. Under an agreement signed with Banner in November 1959, Pima was required to mine and mill an average of 256,670 tons annually.

Strong & Harris, Inc., produced high-silica copper ore from an open pit on the Burro claims in the Cochise district, Cochise County. The ore was trucked to Dragoon for rail shipment to the Asarco smelter at El Paso,Tex., and to the Phelps Dodge Corp. smelter at Douglas.

West Range Mines Co., two-thirds owned by Noranda Mines, Ltd., and one-third by Iso Mines, Ltd., of Toronto, Canada, was active in the Patagonia area. The company reportedly held 87 claims, including 42 claims on which preliminary study and exploration indicated the existence of copper mineralization under a leached area; 16 claims considered to have appreciable silver values; and 29 claims containing a brecciated porphyry copper stock, tested sections of which averaged 2 percent copper.[5]

Gold.—Production of gold in Arizona was 8,752 ounces or 6 percent less than that of 1961. Eighty-six percent of the gold was recovered as a byproduct of copper ores; 13 percent was recovered from com-

[5] Mining World. V. 24, No. 10, September 1962, p. 67.

plex copper-lead-zinc ores; and the remaining 1 percent was recovered chiefly from ores of silver and gold. Output primarily was by five large companies producing over 90 percent of the total production.

According to the annual report of Magma Copper Co., the copper ores mined at the Magma mine contained 0.025 ounce of gold per ton, compared with 0.036 ounce in 1961 and 0.040 ounce in 1960. Production of gold at Magma totaled 8,258 ounces, compared with 14,641 ounces in 1961. The 44-percent decline in output was caused by the interruption of operations for 2 months and the lower average grade of ore. Production from the San Manuel mine declined 15 percent from 17,597 ounces in 1961 to 15,025 ounces, because of the lower average grade of ore processed.

The Phelps Dodge Corp. annual report to shareholders showed that the combined output of gold recovered as a byproduct of copper mining at Morenci, New Cornelia, and Copper Queen Branches totaled 90,000 troy ounces, compared with 94,000 ounces in 1961. It was assumed that the gold content of the ore declined, because the tonnage mined at the three properties was greater than that of 1961.

Shattuck Denn Mining Corp. reported to its shareholders that gold production at the Iron King mine totaled 18,347 ounces, up 26 percent from the 14,549 ounces produced in 1961. The balance of the State gold production was obtained from a number of smaller producers.

Cochise County was the leading gold-producing county, followed in descending order by Pima, Pinal, Yavapai, Greenlee, Gila, Mohave, Yuma, Santa Cruz, and Maricopa Counties.

Americana Investments, Inc., reportedly purchased the Tom Reed Gold Mining Co. properties in the Oatman mining district from Sawyer Petroleum Co. About 900 acres of land, several former producing mines, and other assets were included in the transactions. A new 1,000-ton multipurpose cyanide mill was planned to recover gold and silver from an estimated 1.25 million tons of tailings accumulated during operations of the Tom Reed mill from 1904 to 1939. The mill was designed to process daily either 1,000 tons of tailings or 500 tons of ore.

The dryland gold dredge, Geraldine, owned by United Placers Industries, Inc., was moved to the Middle Camp placers in the Quartzsite district of Yuma County from its previous location near Morristown. The dredge, equipped with a multiple-screening machine and four dry-separation machines, reportedly was capable of handling 75 to 100 tons of gravel per hour.

Mexico-Pacific Mining Co. obtained options on 30 unpatented gold mining claims on the east slope of Sugar Loaf Mountain, Maricopa County, from Noble Heck. Exploration work continued throughout 1962.

Iron Ore.—The value of the output of iron ore was five times greater than in 1961. Direct shipping hematite ore was produced by George B. Smith Chemical Works from the Sally mine in Mohave County and by Ferro-Oxide Research, Inc., from a stockpile in Yavapai County. Arkota Steel Corp. produced magnetite from the Omega mine in Pinal County. Sponge iron was produced from pyrite by the Ray Mines Division, Kennecott Copper Corp., at Hayden and from

iron oxides obtained in the smelting process by Phelps Dodge Corp. at Douglas. Also, a small quantity of magnetite ore was shipped by E. M. Seitz from the Margaret Howard mine in Gila County.

The Colorado Fuel and Iron Corp. (CF&I) was granted a 2-year extension of its prospecting permit for 120,000 acres of Fort Apache Indian Reservation lands in Gila and Navajo Counties. The company requested the extension to permit additional drilling and to study the feasibility of bringing a railroad into the area of the Chediski and Apache iron deposits. The 2-year extension also was needed to determine the feasibility of a beneficiation plant in the area. The Apache and Chediski iron deposits were the subject of a Bureau of Mines study in the early 1940's.

Lead.—Production of lead in Arizona totaled 6,966 tons, a 17-percent increase over the 1961 output. In 1962, the first upturn in production since 1958 occurred. Production, however, was 29 percent below the 5-year average for 1957–61 (9,752 tons). The value of 1962 production increased only 5 percent over that of 1961, because of the lower average price of lead. Iron King mine (Yavapai County), operated by Shattuck Denn Mining Corp., was the principal producer, with an output of 4,869 tons of lead recovered from lead-zinc ore, as stated in the company annual report to stockholders. Production from this property represented 70 percent of the total State output. Nash & McFarland, the second largest producer in the State, operated the Flux mine in Santa Cruz County. BS & K Mining Co., operators of the Atlas mine in Pima County, was ranked third. Yavapai County, with five operations, led the State with 5,928 tons, or 85 percent of the total output. Santa Cruz County, with four operations, was second, accounting for 13 percent of the production. The remaining 2 percent was produced by eight operations in six counties.

Mercury.—A small quantity of mercury was produced from two mines in the Mazatzal Mountains of Arizona. The Pine Mountain mine (Turnbull claims), Maricopa County, the leading producer, was operated part of 1962 by Bacon, Grimes & Brunson and part of the year by Bacon & Brunson. The Ord mine, Gila County, was operated by Amity Mining and Exploration, Inc. The mercury content of the ore ranged from 0.19 percent to 0.25 percent and averaged 0.21 percent.

Molybdenum.—Arizona was ranked third in the Nation in the output of molybdenum concentrate, accounting for 9 percent of the U.S. production. Colorado, the Nation's leading producer of molybdenum, obtained all of its production from processing molybdenum ores, whereas Arizona production along with that of Utah (second largest) was derived as a byproduct in processing copper ores.

Six producers contributed to the State production of 4.7 million pounds, a 2-percent decline from the 1961 output. Shipments of molybdenum totaled 4.4 million pounds valued at $5.9 million, compared with 4.9 million pounds valued at $6.2 million in 1961. The average price of molybdenum in concentrate was $1.33 per pound, compared with $1.28 in 1961. Exports accounted for 369,736 pounds, or 8 percent of the total shipments. Stocks of molybdenum concentrates on hand December 31, contained 356,563 pounds of molybdenum, 275,750 pounds more than was on hand December 31, 1961.

U.S. consumption of molybdenum was 9 percent greater than in 1961. Molybdenum use in high-speed steels increased 31 percent and in hot-worked steel 33 percent. Its use in stainless steel, however, decreased 10 percent. The increased use of molybdenum was evidence of its growing importance in ferroalloying. Listed in decreasing order of production, the mines and operators were San Manuel, Magma Copper Co., San Manuel Division; Esperanza, Duval Sulphur & Potash Co.; Morenci, Phelps Dodge Corp.; Silver Bell, Asarco; Inspiration, Inspiration Consolidated Copper Co.; and Bagdad, Bagdad Copper Corp.

Duval Sulphur & Potash Co. finished exploring and evaluating the Ithaca Peak copper-molybdenum ore body at Mineral Park near Kingman.

Also Duval Sulphur & Potash Co. reported that molybdenum production from the Esperanza mine was down slightly from 1961 because of the lower molybdenum content of the ore milled. Percentage recovery of molybdenum increased, but unit production cost remained unchanged from 1961. Markets for metal remained firm throughout 1962. The average value of molybdenum marketed during the year was 5 percent higher than in 1961.

Inspiration Consolidated Copper Co. closed the molybdenum recovery unit at the Inspiration mill for major modifications in April. The alterations were completed in late October. Difficulties in control that had prevented the company from producing a satisfactory product consistently or achieving proper recoveries were eliminated. According to the company report, during the 3 months before shutdown, the company produced 30,660 pounds of molybdenum concentrates. In November and December, following plant modification, the company produced 86,713 pounds. Production during the 5 months the plant operated totaled 117,373 pounds, compared with 191,710 pounds for the entire year 1961.

Asarco finished construction and placed in operation an addition to its molybdenum recovery unit at the Silver Bell copper concentrator 40 miles northwest of Tucson. Erected under contract by Western Knapp Construction Co. at an estimated cost of $400,000, the new plant materially increased the production of byproduct molybdenum concentrates from the copper ores of the El Tiro and Oxide pits. The new plant was to take over the molybdenum operation that had functioned at Silver Bell since 1956.

Molybdenum output by Bagdad Copper Corp. was lower than in 1961 because the company mill was closed for several months. Changes in the mill were finished and the company expected that 1963 production would exceed that of 1961. Receipts for molybdenum were $99,420 compared with $208,810 in 1961, according to the company report to shareholders.

Silver.—Production of silver from mines in Arizona increased 334,000 troy ounces (7 percent), principally because of significant increases in output from the Mission Unit operated by Asarco and from the Iron King mine operated by Shattuck Denn Mining Corp. In 1962, the four leading companies—Phelps Dodge Corp., Asarco, Shattuck Denn Mining Corp., and Magma Copper Co.—accounted for 75 percent of the total State output. These companies supplied

77 percent in 1961. Eighty-four percent of the silver was recovered from copper ores; 14 percent came from lead-zinc ores; and the remainder from complex ores of copper, lead, zinc, gold, and silver, and from miscellaneous materials. Counties in which production occurred, listed in order of descending production, were Mohave, Navajo, Coconino, Yuma, and Maricopa.

B.O. & W. Mining Co. shipped its first carload of lead-silver ore from Silver Belle-Martinez mine 15 miles northeast of Florence. Since taking over the property, first opened in 1870, the present group sank a new inclined shaft and constructed a 100-ton-per-day mill.

Arizona Silver, Inc., started mining and milling silver-lead ore from holdings on the east slope of Mineral Mountain 18 miles northeast of Florence. Diamond drilling reportedly disclosed mineralization averaging 10 ounces of silver per ton and 18 percent lead.

Uranium Ore.—Thirty-one operations in Apache, Coconino, and Navajo Counties produced uranium ore, compared with 42 operations in the same counties in 1961. Shipments of uranium ore totaled 143,196 tons valued at $3 million, a 37-percent decline in shipments and a 39-percent drop in value. The average value per ton of ore was $21.28, compared with an average value of $21.75 in 1961. The average grade of ore shipped from mines in Arizona was 0.26 percent uranium oxide (U_3O_8). The grade of ore ranged from 0.10 to 0.90 percent U_3O_8, compared with 0.13 and 0.43 percent in 1961. Apache County was the largest producer among the three producing counties.

Operations were not immediately resumed following the collapse of the ore bin at the Western Equities, Inc., Orphan mine, in December 1961, because of the dispute over ownership of ore extending beyond the Orphan claim under the Grand Canyon National Park. This question was resolved by an Act of Congress, Public Law 87-457, on May 28. Under this legislation, Western Equities was to convey to the United States title to the 20.6-acre, patented Orphan claim and also any right to pursue extra-lateral rights to ore under National Park land. In exchange, Western Equities acquired 25-year rights to mine and remove whatever ore could be removed through the existing shaft on the Orphan claim and additional workings beyond the northeast boundary, extending along the dip of the ore body that had its apex within the claim. Ore extracted beneath National Park lands would be subject to royalty payments.

TABLE 9.—Mine production of uranium ore, by counties[1]

County	1961				1962			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]
Apache	16	89,421	448,032	$1,850,395	20	88,217	407,190	$1,655,597
Coconino	17	76,701	422,928	1,780,188	4	404	1,744	6,898
Navajo	9	62,103	319,337	1,333,922	7	54,575	326,660	1,384,411
Total	42	228,225	1,190,297	4,964,505	31	143,196	735,594	3,046,906

[1]Receipts at mills based on data supplied to the Bureau of Mines by AEC.
[2]F.o.b. mine value; base price, grade premiums, and exploration allowances.

Ores from the Orphan mine were allocated by the Atomic Energy Commission (AEC) to the Tuba City processing plant operated by El Paso Natural Gas Co., successor to Rare Metals Corporation of America. The original AEC contract to purchase uranium oxide concentrate produced at the Tuba City mill expired on March 31. Upon passage of Public Law 87–457, negotiations were begun on a new contract to provide for the processing of ores from the Orphan mine and other properties in the area, primarily from Navajo Tribal properties. A new contract was approved on November 19, covering the period from September 30, 1962, through December 31, 1966. Enacting Public Law 87–457 and signing the new purchase contract removed the uncertainties of operations at the Orphan mine. A small quantity of ore broken in 1961 was shipped to the Tuba City mill by the close of 1962 and complete resumption of operations was expected early in 1963.

Vanadium.—Production of vanadium was from uranium ores produced in Apache and Navajo Counties and treated in vanadium recovery units at uranium plants operated by Climax Uranium Co., American Metal Climax, Inc., at Grand Junction, Colo.; Vanadium Corporation of America (VCA) at Durango and Naturita, Colo.; and Kerr-McGee Oil Industries, Inc., Shiprock, N. Mex. The quantity of vanadium recovered was below that of 1961.

Zinc.—Production of zinc in Arizona increased 11 percent in quantity and 11 percent in value above the 1961 output. The Iron King mine, Yavapai County, the major producer of zinc in the State, was operated throughout 1962. According to the Shattuck Denn Mining Corp. annual report for 1962, the Iron King mine produced 15,735 short tons of zinc or one-half of the State total. Other major producers were the Old Dick mine, Cyprus Mines Corp.; Johnson Camp mine, McFarland & Hullinger; the Atlas mine, BS & K Mining Co.; Copper Queen mine, Cyprus Mines Corp.; and the Flux mine, Nash & McFarland.

Exploration on the Iron King mine property during 1962 was mainly mapping and drilling the principal ore-structure extension south of the present workings. Testing the vein near and parallel to the main ore-vein system was continued. Preparations were made for a new system of ore extraction to be in use on an entire level of the mine by mid-1963. Agricultural byproduct research was directed toward testing and evaluating a soil supplement made from Iron King mill tailings.

NONMETALS

Asbestos.—Jaquays Mining Corp. operated the Regal and Chrysotile asbestos mines in the Salt River canyon district (T. 5 N., R. 17 E.). Selectively mined ore was hand-sorted at the property and shipped to the company asbestos mill at Globe. Processed fiber was sold to the General Services Administration at the Globe purchase depot and to out-of-State purchasers.

Cement.—Arizona Portland Cement Co., a division of California Portland Cement Co., and Phoenix Cement Co. Division, American Cement Corp., produced portland and masonry cements at plants located in Pima and Yavapai Counties, respectively.

The average price of portland cement produced and shipped in Arizona was $2.91 per barrel (376 pounds) compared with $3.04 in 1961. The price of masonry cement was $4.35 per barrel (376 pounds) compared with $4.38 in 1961. Limestone used in producing cement clinker was obtained from mines in the area.

The halfway mark in the delivery of cement to the Glen Canyon Dam was reached in March when the 1.65 millionth barrel was delivered. Since deliveries began in February 1960, 11,600 truck round trips, averaging 385 miles per trip, had been logged. Completion of the dam was scheduled for spring 1964.

The 4-millionth cubic yard of concrete for Glen Canyon was poured in November. The dam was to contain about 5 million cubic yards of concrete when completed.

Clays.—Production of clay, excluding fire clay and bentonite, was 16 percent lower in quantity and 23 percent lower in value than in 1961. Output of clay, including fire clay and bentonite, was reported from five counties; Pima and Yavapai Counties were the principal producers. Production of clays also was reported in Apache, Gila, and Maricopa Counties. Clays for heavy clay products, building and paving brick, drain and sewer tile, and other commodities consumed nearly 55 percent of the total output; the remaining 45 percent was used in portland and masonry cements, art pottery, and glaze slip, and as a catalyst in oil refining.

Diatomite.—A small quantity of diatomaceous earth was produced from the White Cliffs mine near Mammoth in southeastern Pinal County by American Diatom, Inc. Diatomaceous earth produced by the company was used in manufacturing acoustical tile, cement-block sealer, flat-paint bases, insecticides, and building-block slabs. The company announced plans for a $250,000 expansion of its facilities at this site. For reserves, the company staked out mining claims on 20,000 acres. The property of Phoenix Gems, Inc., a diatomite producer in 1961, near San Manuel was inactive.

Feldspar.—International Minerals & Chemical Corp. (IMC) recovered potash feldspar (orthoclase and microcline) from pegmatites at the Taylor mine operated by G. R. Haynes in Mohave County. Most of the output from the property was ground at the IMC Kingman mill and sold or used for manufacturing glass and pottery.

Feldspar-silica mixtures, containing 70 percent feldspar, were obtained from the San Antonio mica mine in Pima County by Richard Ballestros.

Gem Stones.—Various gem stones and ornamental stones found in 13 Arizona counties had a total value of $119,500, compared with $119,000 in 1961. The value of gem and ornamental stones collected in Gila County was greater than in any other county in the State. Yavapai County was second.

Gypsum.—Output of crude gypsum from mines in two counties rose 3 percent as demand for gypsum products continued to increase. Arizona Gypsum Corp. operated two properties, one in Pinal County near Winkelman and the other in Yavapai County near Camp Verde. Output of the two properties was sold uncalcined for agricultural use and as cement retarder. National Gypsum Co. operated a mine near Winkelman and calcined the crude gypsum for use in manufacturing wallboard and lath at the company-owned plant in Phoenix.

Lime.—Lime used in concentrating copper ores accounted for more than 88 percent of all the lime sold or used. Forty-seven percent of this total was produced at copper company plants. The steel industry was the second largest user. Lime also was used by the construction, food, and other industries. Six limeburning plants were operated during the year, one each at Cochise, Greenlee, Pinal, and Yavapai Counties, and two in Gila County. Natural gas was the main fuel used. Annual capacity of the six plants operating in Arizona was estimated at 214,000 tons.

The limestone used to produce lime at Kennecott Copper Corp. new lime plant at Hayden contained coarse chert as the principal impurity. Articles[6] were published describing this plant. As received from the quarry, the limestone assayed 5.4 percent silica, 1 percent iron, 49.7 percent lime, and 1.8 percent alumina. The burned product contained 72 percent available lime. Before the installation of the new lime plant, the concentrator operated on lime purchased from a Douglas producer.

Mica.—A small quantity of scrap mica produced by Buckeye Mica Co. at its mine in Maricopa County was sold mainly for roofing materials.

Perlite.—Production of perlite in Arizona increased 3 percent over that of 1961. Arizona Perlite Roofs, Inc., operated the Adams and Iberri quarries near Superior in Pinal County. Harborlite Corp. operated the Harborlite quarry in the same general area and shipped crude perlite to a company-owned plant at Escondido, Calif. Expanded perlite produced by Supreme Perlite, Inc., at its expanding plant near Phoenix was used primarily as a plaster aggregate replacing sand. The expanded products also were used for loose fill insulation, concrete aggregate, and soil conditioning. The average weight per cubic foot of expanded perlite was 8 pounds. Crude perlite sold for $6 to $9 per ton. Weighted average value of crude and expanded perlite was $8.26 and $84.71, respectively.

Pumice.—Arizona led the Nation in the output of pumice and pumicite materials, accounting for more than 33 percent of the U.S. production. Total pumice or pumicite sales from deposits of scoria in Coconino County, volcanic cinders in Cochise, Coconino, Graham, and Yavapai Counties, and pumice in Coconino and Yavapai Counties were 1 percent higher in quantity and 13 percent lower in value than in 1961. Material produced at eight properties was sized and graded for use as concrete admixtures, concrete aggregate, railroad ballast, and other uses.

Coconino County was the largest producer of pumice, accounting for more than 97 percent of the production.

Renewed activity was reported at the zeolitized volcanic ash deposits being explored by Union Carbide Nuclear Co. Division, Union Carbide Corp., in Graham and Cochise Counties. Holdings by the company were reported to include 200 claims (4,000 acres) of Federal land in Graham County and 2,560 acres of State land in Cochise County held by State prospecting permits.

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[6] Huttl, John B. Kennecott Adds Unique Lime Plant to Hayden Reduction Works. Eng. and Min. J., v. 163, No. 11, November 1962, pp. 94–96, 101.
Mining World. Ray Produces Milk of Lime Reagent Using Ellernan Vertical Calciners: V. 24, No. 3, March 1962, pp. 34–36.

Pyrite.—Ray Mines Division, Kennecott Copper Corp., recovered pyrite as a byproduct of milling copper ore at Hayden and used it to produce sulfuric acid and sinter (sponge iron). The company also purchased a small quantity of pyrite from Magma Copper Co. Magma mine as a supplemental feed for its sulfuric acid and sponge-iron plant. The sulfuric acid and sponge iron produced were used in the company copper concentrator for leaching and precipitating the copper occurring in the ore as oxide copper minerals. Ore mined at Ray during the third and fourth quarters contained insufficient nonsulfide copper to justify full-time operation of the leaching and precipitating system, and the sponge-iron and acid-plant operation was reduced to a 5-day week.

Sand and Gravel.—In terms of value, sand and gravel was ranked second of all mineral commodities produced in the State. A 12-percent decline in sand and gravel sold and used lowered the State total to 15.6 million tons, valued at $17.4 million, an increase of 8 percent. Commercial and noncommercial sand and gravel each accounted for approximately 50 percent of the production and value. Maricopa County was the center of production with an output of 6.8 million tons valued at $6.8 million. Pima County was ranked second with 1.8 million tons valued at $1.7 million.

Stone.—Output of stone from 57 operations contributed 1 percent of the total value of mineral production in the State. Stone production increased from 3.6 million tons in 1961 to 4.3 million tons, a 21-percent increase. The increase in production, 751,000 tons, was the result of an increased output of crushed basalt (301,000 tons), crushed sandstone (268,000), crushed miscellaneous stone (182,000), and crushed granite (106,000). Other stone production—dimension limestone, crushed marble, dimension marble, and dimension slate—increased but contributed little to the 21-percent rise in production. Only crushed limestone and dimension sandstone failed to increase in volume of output.

Basalt was quarried and processed in Apache and Greenlee Counties for use as road metal and in concrete by three contractors working for the Bureau of Public Roads.

The Allen Granite Co., Maricopa County, produced 13,431 tons of commercial crushed granite used as road metal and in concrete. Noncommercial granite for riprap was produced by M. M. Sundt Construction Co. and Frank G. Furman, contractors for the U.S. Army Corps of Engineers and the Bureau of Reclamation. Production was reported in Cochise and Yuma Counties.

TABLE 10.—Sand and gravel production in 1962, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Apache	950	$2,059	Pima	1,752	$1,717
Cochise	655	548	Pinal	929	889
Coconino	1,189	1,464	Santa Cruz	3	4
Gila	204	239	Yavapai	659	518
Graham	218	237	Yuma	1,013	757
Greenlee	46	44	Undistributed	398	483
Maricopa	6,777	6,802			
Mohave	(1)	(1)	Total	15,579	17,404
Navajo	786	1,643			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 11.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Construction sand:				
Building	1,885	$2,556	1,556	$2,047
Paving	772	637	636	655
Railroad ballast	8	8		
Fill	253	285	112	81
Other	17	15	94	120
Industrial sand:				
Blast	(1)	(1)	1	3
Engine	(1)	(1)		
Oil (hydrafrac)	20	204	19	206
Other	17	21	32	58
Total	2,972	3,726	2,450	3,170
Construction gravel:				
Building	1,669	2,129	1,984	2,366
Paving	3,408	2,659	2,735	2,521
Railroad ballast	(1)	(1)	(1)	(1)
Fill	1,794	596	458	322
Other	351	412	142	105
Miscellaneous gravel	89	177	128	156
Total	7,311	5,973	5,447	5,470
Total sand and gravel	10,283	9,699	7,897	8,640
Government-and-contractor operations:				
Sand:				
Building	909	1,809	151	151
Paving	898	657	2,028	3,694
Fill	56	21	143	48
Total	1,863	2,487	2,322	3,893
Gravel:				
Building	3,394	6,776	207	205
Paving	6,407	5,738	5,090	4,636
Fill			18	5
Other	6	6	45	25
Total	9,807	12,520	5,360	4,871
Total sand and gravel	11,670	15,007	7,682	8,764
All operations:				
Sand	4,835	6,213	4,772	7,063
Gravel	17,118	18,493	10,807	10,341
Total	21,953	24,706	15,579	17,404

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

TABLE 12.—Stone production in 1962, by counties

County	Short tons	Value	County	Short tons	Value
Apache	80,680	$121,019	Navajo	205,310	$324,390
Cochise	436,130	1,086,786	Pima	758,207	843,329
Coconino	318,643	898,621	Pinal	(1)	(1)
Gila	121,076	148,701	Yavapai	706,684	825,242
Greenlee	707,815	1,043,323	Yuma	190,920	282,361
Maricopa	29,539	45,766	Undistributed	778,138	996,369
Mohave	(1)	(1)	Total	4,333,142	6,615,907

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 13.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1958	(1)	(1)	(1)	(1)	3,600	$62,800	1,122,800	$1,399,540
1959	87,968	$58,762	(1)	(1)	(1)	(1)	1,345,200	1,678,900
1960	(1)	(1)	647,441	$651,845	(1)	(1)	1,782,967	2,079,263
1961	7,155	7,155	285,371	285,850	4,513	60,732	2,099,455	2,458,371
1962	113.274	117,424	586,323	879,482	12,528	104,929	1,986,091	2,430,203

Year	Sandstone		Slate		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1958	322,747	$1,194,746	----------	----------	78,831	$73,483	1,527,978	$2,730,569
1959	238,101	820,146	----------	----------	796,416	1,440.647	2,467,685	3,998,455
1960	490,339	1,175,090	----------	----------	1,328.560	1,200,710	4,249,307	5,106,908
1961	334,557	942.155	----------	----------	851,276	872,217	3,582,327	4,626,480
1962	601,532	1,486,902	84	$837	1,033,310	1,596,130	4,333.142	6,615,907

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

TABLE 14.—Stone sold or used by producers, by uses

Use	1961		1962	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction, short tons	3,926	$38,813	412	$7,315
Rubble, do	2,121	8,852	356	4,991
Rough architectural, cubic feet	[1] 600	1,350	[2] 15,867	9,245
Dressed architectural, do	[3] 427	1,116	[4] 267	641
Flagging, do	[5] 55.598	47.736	[6] 100,318	77,079
Total (approximate, in short tons)	10,294	97,867	9,527	99,271
Crushed and broken stone:				
Riprap, short tons	33,063	25,023	99,843	110,261
Metallurgical, do	429,713	939,809	510,532	1,094,554
Concrete and roadstone, do	1,421,648	1,446,994	1,971,099	3,042,468
Other, do	[7] 1,687,609	[7] 2,116.787	[8] 1,742,141	[8] 2,269,353
Total, do	3.572.033	4.528,613	4,323.615	6.516,636
Total stone (approximate, in short tons)	3,582.327	4,626,480	4,333,142	6,615,907

[1] Approximately 45 short tons.
[2] Approximately 1,215 short tons.
[3] Approximately 32 short tons.
[4] Approximately 20 short tons.
[5] Approximately 4,170 short tons.
[6] Approximately 7,524 short tons.
[7] Includes stone used in cement, lime, abrasives, roof granules, pottery, porcelain, tile, terrazzo, plaster sand, stucco, landscaping, agriculture, and mineral food.
[8] Includes stone used in cement, lime, stucco, roofing granules, pool mix, terrazzo, ornamental aggregate, abrasives, enamel, pottery, porcelain, and tile.

Dimension limestone quarried by Charles D. Withers was used for rough construction. Limestone was quarried and crushed by nine operators in seven counties. Output was 5 percent less than in 1961. Crushed limestone was used principally for producing cement and lime, as a flux in the copper industry, and as an aggregate in concrete. Commercial crushed limestone was priced at $1.22 per ton, dimension stone at $28.00.

Marble quarried and prepared by seven producers in four counties was used as building stone, ornamental stone, roofing granules, aggregate, terrazzo, and rubble. Dimension stone was priced at $12.50 per ton ($1.06 per cubic foot), terrazzo at $12.49 per ton, and roofing granules at $6.78 per ton.

Miscellaneous noncommercial crushed stone was produced by contractors for the Bureau of Public Roads, the Arizona State Highway Department, and the Yuma County Highway Department for use as concrete aggregate and road metal. Production totaled 1 million tons valued at $1.6 million.

Sandstone was quarried in 10 counties. Output of dimension sandstone was below the 1961 production, whereas crushed sandstone increased 83 percent in quantity and 65 percent in value. Government-and-contractor operations accounted for 48 percent of all crushed sandstone, and commercial operations quarried the remainder. Crushed sandstone was used primarily as a smelter flux and as a refractory stone (ganister). Commercial crushed sandstone was priced at $3.06 per ton; noncommercial sandstone was sold at $1.58. Dimension sandstone quarried and prepared in 5 counties by 14 producers was used as rough construction material, rubble, rough architectural stone, dressed stone, and flagging. Price averaged about $10.00 per ton or $0.80 per cubic foot.

Slate was quarried and processed by Ellis N. Collins at the Green Eagle quarry for use as rough and dressed construction material, rubble, and flagging. The average price was $5.45 per ton for rough dimension and construction slate, $0.83 for rubble, and $11.52 for flagging.

Vermiculite.—Ari-Zonolite Co. operated its Glendale exfoliated-vermiculite plant at Glendale in Maricopa County using out-of-State crude ore. The exfoliated product was used as lightweight aggregate in concrete and plaster, insulation, and in agricultural and acoustical products.

MINERAL FUELS

Coal (Bituminous).—Lawrence Isaac Coal Co. produced less than 1,000 tons of coal from the Black Mesa coal seam of the Cow Spring No. 3 mine in Coconino County.

Petroleum and Natural Gas.—Production of petroleum from wells in Apache County was below that of 1961. However, 1962 was the most active year on record for the State for oil exploration with 54 completions. Twice the number of wells was drilled, as compared with 1961. The activity, including 41 exploratory and 13 development wells, resulted in 1 oil and 9 infield gas discoveries. Much of the development drilling was aimed at locating helium reserves in Pinta Dome field rather than hydrocarbons. Oil activity in the State was primarily exploratory and confined to three general areas of interest: The northeastern corner of the State flanking existing Pennsylvanian and Mississippian production; the Vernon area, south of the town of St. Johns in southern Apache County; and the area around the town of Holbrook in Navajo County, ranging westward into southeastern Coconino County.

TABLE 15.—Wildcat- and development-well completions in 1962, by counties[1]

County	Crude	Gas	Dry	Total	Footage
Wildcat:					
Apache	1		17	18	46,300
Coconino			3	3	7,800
Maricopa			1	1	200
Navajo		6	11	17	21,000
Pima			1	1	1,100
Yuma			1	1	5,500
Total	1	6	34	41	81,900
Development: Apache		3	10	13	19,800
Total all drilling	1	9	44	54	101,700

[1] No condensate wells.

Source: Oil and Gas Journal.

Apache County, the most active area in the State, accounted for 31 of the State 54 completions, 18 exploratory, and all 13 development wells. The remaining 23 exploratory wells included 11 dry holes drilled in Navajo County, 3 in Coconino, and 1 each in Maricopa, Pima, and Yuma. Total drilling in the State included 19,762 feet of development and 81,896 feet of exploration drilling for a cumulative total of 101,658 feet.

The Oil and Gas Commission adopted changes in the State production regulations. Most significant was a proposal to allow the major operator to control production in a field should demand be exceeded. The commissioners also voted favorably for legislation requiring compulsory unitization in a field if 62.5 percent of the field operators approved unitization.

REVIEW BY COUNTIES

Apache.—The mineral economy of Apache County centered around the uranium industry. The U_3O_8 content of the 88,217 tons of ore shipped during 1962 ranged from 0.13 to 0.36 percent, averaging 0.23 percent on a weighted basis. The f.o.b. mine value of the ore ranged from $6.76 per ton to $31.20, averaging $18.77. The total value of uranium ore shipments was $1.7 million. Principal producers of ore were Kerr-McGee Oil Industries, Inc., at Mesa Group mines and VCA at the Monument No. 2 mine. Other producers operating in the county were Thomas Clani (Black Rock Point mine); Robert Goode (Cisco No. 3); Climax Uranium Co. (Frank No. 1, and Frank Jr., Cato No. 1); Harold Broshears (Last Chance); and W. D. Tripp (Tony Tuck and Tony Tuck No. 2). Vanadium recovered from Apache County uranium ore was processed in Colorado and New Mexico uranium mills equipped with vanadium recovery units.

The county was the scene of the only oil discovery in the State in 1962. Pan American Petroleum Corp. new well, Navajo Tribe-F, located in NW¼, SW¼, sec 6, T 40 N, R 28 E, was completed in August. Reportedly, the well flowed 50 barrels of 37.5 gravity oil and 28 barrels of salt water per day from the Akah member of the Paradox

formation. The new field was 4.5 miles west of Mississippian production at Dry Mesa and 6 miles southwest of Pennsylvanian production in the East Boundary Butte field. The closest drilling was two dry holes located 3 miles south of the Paradox discovery.

Petroleum production was 41 percent lower than in 1961. Among the 54 wells drilled in Arizona during 1962, 31 were in Apache County. Drilling in the county totaled 19,762 feet of development and 46,333 feet of exploration drilling. Three development gas wells and one exploratory oil well were successful.

Helium production from wells in Apache County was 60 times as great as that of 1961.

Output of sand and gravel sold and used was 1 percent more than in 1961. Stone production declined from 133,500 tons valued at $133,500 in 1961 to 80,680 tons valued at $121,019.

Cochise.—Cochise County was ranked first in gold production and third in silver output. The value of copper output comprised 89 percent of the total value of mineral output in the county.

Copper Queen Branch, Phelps Dodge Corp., was the leading producer of mineral wealth in the county. The company was first in the State in gold and silver production and third in copper production. Gold output from the Copper Queen mine declined 19 percent and silver 2 percent, whereas copper production increased 4 percent. Ac-

TABLE 16.—Value of mineral production in Arizona, by counties

County	1961	1962	Minerals produced in 1962 in order of value
Apache	[1] $5,001,845	[2] $7,333,518	Vanadium, sand and gravel, uranium ore, helium, clays, stone, petroleum, gem stones.
Cochise	48,857,698	51,289,505	Copper, gold, stone, silver, lime, zinc, sand and gravel, pumice, tungsten ore and concentrate, lead, gem stones.
Coconino	[1] 4,930,681	3,987,166	Pumice, sand and gravel, stone, copper, uranium ore, silver, gem stones.
Gila	43,569,443	52,827,599	Copper, asbestos, lime, sand and gravel, silver, stone, molybdenum, gold, gem stones, lead, mercury, iron ore, clays, zinc.
Graham	158,979	255,840	Sand and gravel, pumice.
Greenlee	70,016,363	78,150,348	Copper, stone, lime, silver, molybdenum, gold, sand and gravel, gem stones.
Maricopa	7,883,688	6,946,540	Sand and gravel, stone, clays, mica (scrap), gem stones, mercury, gold, silver.
Mohave	831,854	576,745	Sand and gravel, stone, feldspar, copper, gold, silver, gem stones, lead, zinc, iron ore.
Navajo	1,996,143	3,638,234	Sand and gravel, uranium ore, stone, copper, vanadium, silver, gem stones, zinc.
Pima	106,865,830	127,418,897	Copper, cement, silver, molybdenum, sand and gravel, gold, stone, zinc, clays, lead, tungsten ore and concentrate, gem stones, feldspar.
Pinal	107,827,684	110,131,864	Copper, molybdenum, silver, gold, sand and gravel, gypsum, lime, pyrites, stone, perlite, iron ore, diatomite, lead, gem stones, zinc.
Santa Cruz	636,840	530,975	Zinc, lead, silver, copper, sand and gravel, gem stones, gold.
Yavapai	25,879,720	29,095,274	Copper, cement, zinc, lead, silver, stone, gold, sand and gravel, lime, gypsum, molybdenum, clays, gem stones, pumice, iron ore, beryllium concentrate.
Yuma	705,465	1,080,304	Sand and gravel, stone, copper, gem stones, gold, lead, silver, zinc.
Undistributed [3]	832,608	879,314	
Total	[1] 425,995,000	474,142,000	

[1] Revised figure.
[2] Petroleum value is preliminary.
[3] Includes natural gas (1962) and some stone, sand and gravel (1962), gem stones, and tungsten ore and concentrate (1962) that cannot be assigned to specific counties.

cording to the company annual report to stockholders, production of ore from the Copper Queen underground mine increased 4 percent, from 595,000 tons in 1961 to 618,000 tons. Copper recovered from this ore totaled 30,398 tons in 1961 and 30,742 in 1962, a 1-percent increase. At the Lavender open-pit mine, 9.4 million tons of material was handled, of which 5.4 million tons was ore. This quantity was an increase of 863,000 tons of material handled, of which 446,000 tons was ore. The ratio of waste and leach material to milling ore mined was 2.62 to 1, compared with 2.77 to 1 in 1961. During 1962, 5.7 million tons of ore at an average rate of 18,454 tons per day was treated in the concentrator. Of this total, 5.4 million tons came from the open pit and 310,000 was from underground mines. A total of 843,002 tons was treated at the Douglas smelter, including ore from the underground mines, concentrates from the mill, and copper precipitates from the leach solutions from the Lavender pit. The smelter also treated some copper scrap and some other material on a toll basis.

The Johnson Camp mine, operated by McFarland & Hullinger, was the second largest producer of copper and silver in the county and the principal producer of zinc. According to the Cyprus Mines Corp. annual report, mill throughput at the Johnson Camp mine was 63,000 short tons compared with 61,000 tons in 1961. From a surface operation on the Burro claim Strong & Harris, Inc., produced siliceous copper ore for use as smelter flux.

Nonmetals produced in the county were valued at $2.6 million. Stone, the principal nonmetal produced, was quarried by five operators in the county for use as riprap, smelter flux, concrete, road metal, screenings, lime, and terrazzo. Two operators accounted for all the sand and gravel produced; most of the production was classified as Government-and-contractor. Quicklime and hydrated lime were produced by Paul Lime Plant, Inc. San Xavier Rock and Sand Co., near Douglas, sold volcanic cinders for use as concrete admixtures and concrete aggregate.

Coconino.—Nonmetal production constituted 99 percent of the total value of mineral output. The county was ranked first in production and value of pumice, accounting for more than 96 percent of the State total. Shipments were reported by five producers in the Winona and Flagstaff areas. Superlite Builders Supply Co., near Winona, was the largest producer in terms of value; but on a tonnage basis the Atchison, Topeka & Santa Fe Railway Co. was the largest producer.

Standard Pozzolan Co. (formerly Standard Gilsonite Co., Pozzolan Division) continued to supply the Glen Canyon dam construction project with pumice for use in concrete admixtures at about the same rate as in 1961.

The county was ranked fourth in value of sand and gravel production, most of which was classified as Government-and-contractor. The Bureau of Public Roads was the largest producer of stone in the county.

Coconino County, the second largest producer of uranium ores in the State during 1961, accounted for less than 1 percent of the State total output in 1962. The lower output resulted primarily from the closing of the Orphan mine early in 1962. The 404 tons of ore pro-

duced by four operators in the county averaged 0.22 percent of U_3O_8 and contained 1,744 pounds of U_3O_8. The ore ranged from 0.10 to 0.25 percent U_3O_8 and the value from $4.00 to $20.75 per ton, f.o.b. mine, for an average value of $17.07 per ton. Producers in descending order of shipments were Western Equities, Inc., Orphan mine; Rare Metals Corporation of America, Huskon No. 17; Leon Sterling, Jr., Julius Chee No. 3; and Milestone Hawaii, Inc., Milestone No. 1. The total value f.o.b. mine was $6,898.

A small quantity of copper and silver was recovered by Rare Metals Corporation of America from Tuba City mill tailings.

Gila.—The value of mineral output in Gila County increased $9.3 million (21 percent) above that of 1961. Most of the increase resulted from increased copper production. Copper constituted 96 percent of the total value of mineral production in the county. Most of the copper came from four operations—Inspiration, Copper Cities, Miami, Castle Dome.

According to the annual report of Inspiration Consolidated Copper Co., the investigations undertaken by the company in 1961 developed means by which the company increased maximum treatment capacity of the Inspiration present plant from 15,000 tons per day to 16,500 tons per day. Inspiration Consolidated Copper Co. Inspiration mine (Thornton and Live Oaks pits) was operated throughout 1962, except for the usual holiday shutdowns. In July, however, the tonnage of ore treated per day was reduced to balance output with demand from maximum capacity levels of 16,500 tons per day to 15,000 tons. The company mined 5.6 million tons of ore containing 0.954 percent total copper (0.388 percent oxide copper and 0.566 percent sulfide copper). A total of 3.9 million tons of waste was removed. The ratio of waste to ore was 0.71:1, the same as that reported for 1961. Approximately 1.1 million tons of pit overburden was segregated for leaching. A total of 99.4 million pounds of copper was produced from Inspiration ores, or 17.42 pounds of copper per ton of ore produced. Production from leaching mine dumps accounted for 5.2 million pounds of copper, raising the total copper output to 104.6 million pounds. The molybdenum plant was shut down early in April to permit major alterations in the treatment method; the changes were completed by late October with product quality and recovery reported as excellent. Molybdenum production during the 3 months before shutdown totaled 30,660 pounds. Production during November and December was 86,713 pounds to total 117,373 pounds for 1962. A total of 137,990 tons of copper concentrates, precipitates, and ores were treated at the smelter. Of this total, 77,170 tons was Inspiration production and 60,820 tons was purchased from others or treated for others on toll. New facilities for unloading incoming materials and blending, storing, and delivering them to the reverberatory furnaces were nearly completed at yearend.

The Christmas mine,[7] Inspiration Consolidated Copper Co., began production on September 30, and by December, ore was being mined

[7] Mining World. Christmas start-up means more copper for Inspiration. V. 24, No. 10, September 1962, pp. 28–29.

at a rate of 1,400 tons per day on a 6-day-week basis. The ore came mainly from development drifting in two stoping areas. Total flow of water in the mine had decreased to about 2,200 gallons per minute. Water still impeded the advance of headings under the ore, but since it was below the ore, it did not affect mining in stopes. Mine water was used for milling the ore. Since the start of production on October 1, all copper from Christmas ores was used to build up the in-progress inventories, through the refining stage, necessary to sustain regular production. This inventory accumulation was completed by the end of 1962. Production from the Christmas mine was to be available for sale and delivery to customers in 1963. Only minor difficulties were encountered in starting the mill, which was operated at its rated capacity of 4,000 tons of ore per day. Copper extraction and grade of concentrate were better than indicated by test-mill operations.

Miami Copper Co. Division, Tennessee Corp., the second largest producer in the county, recovered copper at its mining and milling operations at Copper Cities, leached in place at the Miami underground mine, and leached in dumps at Castle Dome. According to the annual report of the parent company, deep test drilling carried out over the past several years disclosed an estimated 25 million tons of low-grade primary ore underlying the present ore reserve at Copper Cities mine. A program to develop this ore over several years was started late in 1962. Based on the current rate of mining, these reserves were expected to extend the life of the open pit by 8 more years. This development program was expected to add a substantial tonnage of stripped material containing some copper mineralization to that already accumulated. Available copper in the stripped material could be recovered by the new leaching and precipitation plant at the Copper Cities mine site.

Other companies and individuals producing copper in the county were Chilito Copper Co., Chilito mine near Hayden; E. M. Moores, Jr., Copper Hill and Echo mines near Globe; Eva H. Schulze, Schulze mine near Miami; and Charles E. Goetz, 79 mine near Phoenix.

Lead ore was produced by Charles E. Goetz at the 79 mine. Gold and silver were recovered as byproducts by leading copper producers. According to Inspiration Consolidated Copper Co. annual report, 117,373 pounds of molybdenum in concentrate was recovered from Inspiration ores. Mercury output came from the Ord mine operated by Amity Mining and Exploration, Inc., and from cleanup operations by Gordon K. Grimes.

Nonmetal production accounted for 3 percent of the value of mineral output. Asbestos and lime were the leading nonmetallic minerals produced. Jaquays Mining Corp. operated the Regal and Chrysotile mines; Metate Asbestos Corp., Pan American Fiber Corp., and Phillips Asbestos Mines shipped from stockpile. Kennecott Copper Corp., Ray Mines Division, and Hoopes & Co. produced quicklime for use in concentrating copper.

Sand and gravel was produced in the county by the Arizona State Highway Department and the Gila County Highway Department for paving. Kennecott Copper Corp. and Hoopes & Co. accounted for most of the stone produced.

Graham.—Sand and gravel and pumice were the only commodities produced in Graham County. Sand and gravel produced by the Arizona State Highway Department, Gila Valley Concrete Co., and W. A. Morris Sand and Gravel Co. accounted for 93 percent of the total value. Pumice and volcanic cinders produced by the Gila Valley Block Co. from the Pumice Nos. 1 and 2 and Blue Bird claims near Safford accounted for the remaining value.

Greenlee.—The county was the third largest producer of copper in the State, contributing more than 19 percent of the State output. Copper supplied 96 percent of the value of mineral production in the county. The Morenci open-pit mine operated by the Morenci Branch, Phelps Dodge Corp., again the largest producer of copper in the State, was ranked second in the Nation. During the first 6 months, the mine was worked at capacity. In July and September, work schedules were reduced to avoid a buildup of copper stocks. According to the company annual report, 43.5 million tons of material was handled, of which 17.0 million tons was ore. The ratio of waste and leached material to ore mined at the Morenci open pit was 1.56 to 1. A total of 16.9 million tons of ore was treated in the concentrator at an average daily rate of 55,080 tons. Copper production increased from 111,443 tons in 1961 to 121,302 tons. Large-scale testing was continued on two separate processes for the recovery of small quantities of oxide copper in the sulfide ores treated at the concentrator. One process being tested was considered for installation in the concentrator. The Morenci mine was the third largest producer of molybdenum in Arizona, fourth largest producer of silver, and fifth largest producer of gold; all three metals were recovered as byproducts from treating copper ore. Construction underway at the concentrator, including a 350-foot-tailings thickener to improve water recovery and a foundation and building additions for two new primary grinding mills, was to increase milling capacity about 7 percent, from 55,000 to 59,000 tons of ore per day. The company operated a limekiln at the property to provide quicklime for metallurgical purposes.

The value of stone output accounted for 54 percent of the total value of nonmetal production. About 84 percent of this output was basalt mined by contractors of the Bureau of Public Roads. The remaining 16 percent comprised crushed limestone and sandstone mined by Phelps Dodge Corp. for use as a flux and for other purposes. J. W. Jones Construction Co. provided the Bureau of Public Roads with sand and gravel for paving.

Maricopa.—Nonmetals accounted for more than 99 percent of the total value of all minerals produced. Maricopa County was again the leading producer of sand and gravel in the State, despite a 19-percent drop in total output. Commercial production valued at $6.4 million consisted of 6.4 million tons or 94 percent of the sand and gravel output. Production of stone by five operators in the county was primarily crushed sandstone used as refractory stone (ganister). Production of miscellaneous clays by Wallapai Brick & Clay Products, Inc., and the Phoenix Brick Yard dropped 64 percent in quantity and value. All of the clay was used in manufacturing building brick and other heavy clay products. Scrap mica was produced at the Buckeye mine and ground at a mill operated by Buckeye Mica Co. near Buckeye. Gem stones valued at $12,896 and consisting of

agate, Apache tears, chalcedony, jasper, and onyx were collected. A small quantity of gold and silver was recovered from two active mines.

Mohave.—Sand and gravel accounted for 59 percent of the total value of mineral production in the county. Contractors for the Arizona State Highway Department and the National Park Service furnished the entire production of paving sand and gravel. IMC produced crushed sandstone for use in abrasives, enamels, pottery, porcelain, and tile. A small quantity of feldspar was mined by IMC at the Taylor mine and ground at the company mill near Kingman for manufacturing glass and pottery. Gem or ornamental stones worth $6,290 were collected by amateur gem collectors and gem dealers. Agate, jasper, and turquoise were collected, and turquoise was the most valuable.

Metals output (gold, silver, copper, lead, and zinc) came from mines located in the Cottonwood, Wallapai, and Owens mining districts. Cerbat Mining & Milling Co., operator of the Golden Gem, Flores, Summit, and Banner claims, was the major producer. A small quantity of hematite (iron ore) was produced by George B. Smith Chemical Works, operator of the Sally mine. Exploration and evaluation of the Ithaca Peak copper-molybdenum deposit at Mineral Park near Kingman was completed by Duval Sulphur & Potash Co. The company decided late in 1962 to proceed with developing the property for production. The final stages of exploration of this ore body included detailed geological studies, evaluation of drilling results, and an underground sampling program. Additional investigation was to be made on all properties held by the company in the Mineral Park area after the ore body being developed was brought into production.

Navajo.—The county was the second largest producer of uranium ore, accounting for more than 44 percent of the State production of U_3O_8. Uranium ore from seven operations furnished 38 percent of the total value of mineral production in the county. Average U_3O_8 content of the ores mined ranged from 0.15 to 0.34, averaging 0.30 for the 54,575 tons of ore mined. F.o.b. mine values ranged from $9.00 for some 0.15 percent U_3O_8 material to $29.30 for 34 percent material. The total value received for the uranium ore shipped, containing 326,660 pounds of U_3O_8, was $1,384,411 or $25.37 per ton f.o.b. mine. Industrial Uranium Co.—operating the Moonlight, East Starlight, Sunlight, and Sunlight South—was the largest producer. Properties of A & B Mining Co., Curtis W. Jones, and Kimmerle & Redd also were operated during 1962. A small quantity of vanadium was recovered from uranium ores produced by A & B Mining Co., Industrial Uranium Co., and Curtis W. Jones. Silver, copper, and zinc accounted for 5 percent of the mineral production value.

Sand and gravel accounted for 45 percent, $1.6 million, of the total value of mineral production in the county. Government-and-contractor production consisted of 660,400 tons or 84 percent of the sand and gravel output, and commercial production by four operators comprised the remainder. Crushed sandstone valued at $324,900 was quarried in Navajo County by Fisher Contracting Co. for the Bureau of Public Roads. Gem stones valued at $3,331—consisting of garnets, petrified wood, and volborthite—were collected by Del-

mann Minerals, Frank DoBell, Allen Hancock, and W. G. Slambaugh.

Pima.—The value of mineral production in Pima County increased from $106.9 million in 1961 to $127.4 million, mainly as a result of the increased value of copper output from $91.0 million in 1961 to $110.8 million in 1962. The value of copper output in 1962 accounted for 87 percent of the total value of all minerals produced in the county. Five mines—New Cornelia, Mission, Esperanza, Silver Bell, and Pima—supplied 95 percent of the copper output in the county and 27 percent in the State, compared with 98 and 25 percent, respectively, in 1961.

According to the Phelps Dodge Corp. annual report to stockholders, the New Cornelia Branch moved 24.5 million tons of material from New Cornelia open-pit mine near Ajo. Of this total, 9.6 million tons was ore and 14.9 million tons was waste. The ratio of waste to ore mined in the Ajo open pit was 1.54:1, about the same as that of 1961. A total of 9.6 million tons of ore was treated in the concentrator during 1962 at an average rate of 31,345 tons per operating day. This operation produced 71,008 tons of copper, compared with 70,334 tons in 1961.

A new model diesel-electric locomotive with a rated capacity of 2,250 hp was purchased by the company. Following evaluation studies, a decision was made to substitute these diesel-electric locomotives for the trolley-electric locomotives that were hauling a part of the material from the open pit. Eight locomotives were ordered for delivery in 1962.

The county's second largest copper producer, Mission Unit of Asarco, completed its first full year of operation.[8] According to the company annual report, the concentrator at the Mission Unit operated in excess of rated capacity throughout 1962. A total of 6.3 million tons of copper ore was treated. The combined quantity of ore and waste handled was 29 million tons. Stripping was maintained at a relatively high rate to develop more fully the ore deposit and thus obtain better grade control. The grade of ore mined during 1962 was somewhat lower than the average grade of the total calculated reserve, but the company expected it to improve as the size of the pit increased and a better grade control attained.

In its annual report for 1962, Asarco stated that the Silver Bell Unit operated normally throughout the year above the rated capacity. Substantial new tonnages of sulfide ore in the El Tiro area were added to the ore reserves. The ore in this area was found to be harder than the average ore that had been treated by the concentrator. A fifth primary ball mill was being installed to be placed in operation early in 1963 so that production rates might be maintained. An addition to the molybdenum section of the mill was completed and began operations, permitting the company to increase the recovery of byproduct molybdenum concentrates.

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[8] Engineering and Mining Journal. Asarco's Mission. V. 163, No. 1, January 1962, pp. 70–79.
Weiss, Norman L., and J. D. Vincent. Design and Operation of the Mission Mill—Part I. Min. Cong. J., v. 48, No. 11, November 1962, pp. 68–72 and 80.
Weiss, Norman L., and J. D. Vincent. Design and Operation of the Mission Mill—Part II. Min. Cong. J., v. 48, No. 12, December 1962, pp. 44–51.
Argall, George O., Jr. Asarco's Mission Copper. Min. World, v. 24, No. 1, January 1962, pp. 19–42.

According to the annual report issued by Cyprus Mines Corp., Pima Mining Co. (50 percent owned by Cyprus Mines Corp.) mined and milled 1.5 million tons of ore averaging 1.54 percent copper. The 79,000 tons of copper concentrates produced at the company mill near Tucson contained 19,700 tons of copper. In 1961, Pima mined and milled 1.4 million tons of ore averaging 1.38 percent copper to produce 64,000 tons of concentrates containing 16,620 tons of copper. As of December 31, proved ore reserves in the existing pit were 11.3 million tons of ore containing 1.09 percent copper. The reserves, which included about 1.6 million tons of ore owned by Banner Mining Co., were to be mined and milled by Pima. The $2-million program to increase the size of the company mill from 3,800 tons to 7,000 tons per day proceeded on schedule. The mill-expansion program was scheduled for completion by October 1963. The addition to the mill was to allow Pima to treat an additional 18 million tons of proved ore averaging 0.66 percent copper. Mining this reserve, lying east and north of the present pit, would extend the life of the Pima operation beyond 1975. The use of a digital computer in determining the economic limit of the open-pit mine expansion program was described.[9]

According to the Duval Sulphur & Potash Co. annual report to stockholders, the Esperanza open-pit copper mine was operated at capacity levels during 1962. Production of copper and molybdenum was down slightly because of the decrease in metal content of ore milled. Continued improvements in milling practice increased the percentage recoveries of copper and molybdenum. Copper leaching and precipitating facilities were completed and placed in operation during the first half of the year. These facilities produced copper from subgrade ore stockpiled adjacent to the pit by the solution-precipitation method. Recovery exceeded expectations both as to volume of production and economy of operation. Copper production from this source amounted to 5 percent of the total production from the entire operation. An increasing rate of production stemming from leaching procedures designed to accelerate the natural rate of dissolution of copper minerals in the leach dumps was anticipated. Plans were completed during the year for developing the copper-molybdenum ore body disclosed by development drilling in 1961 immediately west of the present pit. Stripping the waste capping overlying the ore in this reserve was scheduled to begin in 1963.

The 1962 annual report of Banner Mining Co. stated that Pima Mining Co. had commenced producing ore from Banner ground under the agreement of November 1959. According to the mining and milling agreement with Banner Mining Co., Pima was required to mine and mill an average of 256,670 tons annually from the Daisy mine and to pay Banner Mining Co. for the recovered silver and 7,336,193 pounds of copper after milling, smelting, and refining losses. Pima was reported to have met this average requirement for 1962; Banner received payment for this tonnage less treatment costs. Banner reported that it had received payment for 7.3 million pounds of copper. Banner Mining Co. also reported that Pima excavated and

[9] Olk, James F. An Open Pit Application of a Digital Computer. Min. Cong. J., v. 48, No. 1, January 1962, pp. 35–37.

stockpiled 952,000 tons of oxidized material on Banner property during 1962. This material from the Daisy Cone contained 1.08 percent copper. This brought the total of such material stockpiled on Banner property to approximately 1 million tons. In addition, Pima stockpiled 115,000 tons of low-grade sulfide ore for Banner. Approximately 7,100 tons of the best of these sulfides was concentrated at Banner's Mineral Hill mill. As of December 31, the company drilling program in the group of State mineral-leased claims in the vicinity of the Palo Verde mine indicated low-grade open-pit reserves of about 76.4 million tons. Drilling remained to be done to evaluate this area fully. In addition to copper, the ore had a recoverable molybdenum and silver content.

At the Palo Verde mine, a total of 243,072 tons of ore was produced from stoping and development headings during 1962, for an average of 20,256 tons per month. All the ore produced was milled at the Mineral Hill mill operated by the company. Ventilation also was improved by drilling two additional ventilation holes, which allowed the flow of air through the mine to be increased by 50 percent. Inflow of water into the mine was reduced to less than 250 gallons per minute.

The Atlas mine, operated by BS & K Mining Co., was the main producer of lead and zinc in the county. Most of the gold and silver was recovered as a byproduct of copper mining. All molybdenum production came from the Esperanza mine operated by Duval Sulphur & Potash Co. and from the Silver Bell mine operated by Asarco.

Cement produced at the Rillito plant of Arizona Portland Cement Co. Division, California Portland Cement Co., was the principal nonmetal product. Limestone was the principal stone produced. Most of the limestone was quarried and used by Arizona Portland Cement Co.; a small quantity was used as roofing material and dimension stone. Crushed sandstone was produced for use as a smelter flux. A small tonnage of marble was quarried for dimension stone and roofing granules. Manufacture of building brick and other structural clay products furnished the entire miscellaneous clay production outlet. The leading producers of clay in order of output were Grabe Brick Co., Tucson Pressed Brick Co., and Phoenix Brick Yard.

Of the 1.8 million tons of sand and gravel produced, contractors for the Arizona State Highway Department, the Pima County Highway Department, and U.S. Army Corps of Engineers accounted for the production of 1.1 million tons. Twelve commercial operators produced 605,300 tons of sand and gravel used for building, paving, and fill.

Pinal.—Copper supplied 103 million (94 percent) of the $110-million value of mineral production. Gold and silver were recovered primarily from copper ore, and all molybdenum was recovered from copper ore. Nonmetals produced were sand and gravel, gypsum, lime, pyrites, stone, and perlite.

The major copper-producing mines in order of output were San Manuel, Ray Pit, and Magma.

San Manuel mine [10] was the largest producer in the county and the second largest producer in the State. According to the annual report of Magma Copper Co., the parent company, the San Manuel

[10] Dale, V. B. Mining, Milling and Smelting Methods, San Manuel Copper Corp., Pinal County, Ariz. BuMines Inf. Circ. 8104, 1962, 145 pp.

mine produced 12,565,545 tons of ore assaying 0.748 percent sulfide copper, compared with 12,529,243 tons of ore assaying 0.727 percent sulfide copper in 1961. The tonnage of ore mined per operating day was 35,165, compared with 35,063 tons in 1961. Copper recovery per ton of ore mined was 13.40 pounds in 1962, compared with 13.19 pounds in 1961. Metal production was 84,208 tons of copper, 4,157,051 pounds of molybdenum sulfide, 15,025 ounces of gold, and 302,953 ounces of silver. The mill treated 12.5 million tons of ore at a rate of 34,938 tons per operating day. Approximately 84 percent of the total copper and 91 percent of the sulfide copper contained in the ore were recovered. A total of 303,223 tons of copper concentrate was processed at the smelter during 1962 for an average of 857 tons per operating day. The San Manuel quarry delivered 62,392 tons of limestone and 9,843 tons of quartzite to the plant for metallurgical purposes.

According to the annual report of Kennecott Copper Corp., the development at Ray Mines Division of a new well and acquisition of additional electric power for the concentrator resulted in an alltime high in copper production, despite the third successive year of drought. Showing promise were test applications related to centralized pit-operations control, including closed-circuit industrial television for monitoring shovel loading and citizens-band radio communications for the entire truck fleet. Ore mined and milled at the Ray Mines totaled 7,695,757 net tons, compared with 7,428,104 in 1961. The ore contained 18.3 pounds of copper per ton of ore mined, up slightly from the 18.0 pounds per ton in 1961. Copper production at Ray totaled 66,475 net tons, compared with 64,361 tons in 1961.

According to the annual report of Magma Copper Co., production at the Magma mine near Superior was 337,618 tons of ore assaying 4.74 percent copper, 0.025 ounce of gold, and 0.95 ounce of silver, compared with 410,958 tons assaying 5.16 percent copper, 0.036 ounce of gold, and 1.58 ounces of silver during 1961. The lower production was caused by the interruption of operations by an underground fire from December 1961 to February 1962 and by a lower average grade and daily tonnage of ore mined. The lower production grade was caused partly by dilution from some development headings. Production from the main vein in the central part of the mine was sharply curtailed in comparison with previous years because of the exhaustion of reserves in developed areas.

Production from the east replacement area, about 90 percent of the total Magma mine production, was less than normal and more costly because of the change in shape and structure of the ore body. As mining progressed in depth, the ore body became shorter in length and greater in thickness, and its hanging and foot walls became weak and heavy. This change in the shape of the ore body reduced the number of working areas available for production on a given level. These difficulties were overcome by changing the mining method from what was essentially a long-wall retreat, down dip from level to level, to a horizontal-cut and hydraulic sand-fill method working up dip from level to level. Installation of pipelines and equipment to convey mill tailings for fill into the stoping area was about completed. Use of the new mining method was expected

to start by March 1963. Increased production and lower production costs were anticipated.

Development in the east replacement area proved the continuation of ore in depth and was generally favorable below horizons under production. Additions to ore reserves in the area somewhat exceeded production of the entire mine for the year.

Metal production from the ore milled at Magma included 14,913 tons of copper, 8,258 ounces of gold, and 294,811 ounces of silver. Exploration and development work consisted of 12,728 feet of drifts and crosscuts, 5,526 feet of raises, and 8,771 feet of diamond drilling.

Clays, diatomite, gem stones, gypsum, lime, perlite, pyrite, sand and gravel, and stone, valued at $2.1 million, were the nonmetals produced in Pinal County. Sand and gravel accounted for $888,900 (42 percent) of the total. Contractors for the Arizona State Highway Department and the Pinal County Highway Department accounted for about 82 percent of the total; the remaining tonnage was supplied by four commercial producers.

Pyrite recovered from the milling of base-metal ores was roasted to produce sulfuric acid for copper leaching and sponge iron for precipitation. Limestone produced by San Manuel Division, Magma Copper Co., was converted to quicklime for use at the San Manuel concentrator. The company also quarried and crushed sandstone and limestone for use as a smelter flux. Arizona Gypsum Corp. and National Gypsum Co. produced gypsum from deposits near Winkelman for use as a retarder for portland cement, as a soil supplement, and for other uses. Crude perlite mined by Arizona Perlite Roofs, Inc., and Harborlite Corp. was expanded at Tucson and in California and Texas expanding plants for use in building plasters and other construction materials. Diatomite from the White Cliffs deposits near Mammoth was mined for use as a filtration media by American Diatom, Inc.

Santa Cruz.—The Flux mine operated by Nash & McFarland was the principal producer of gold, silver, copper, lead, and zinc in the county. The Flux mine was ranked second in the production of lead and sixth in production of zinc in the State. A small quantity of sand and gravel produced in the county was used for building.

Yavapai.—Gold, silver, copper, lead, and zinc accounted for 69 percent of the mineral production. The Iron King mine at Humboldt, operated by Shattuck Denn Mining Corp., was the largest producer of lead and zinc in the State and the third largest producer of gold and silver. According to the company annual report, Shattuck Denn Mining Corp. mined and milled 271,171 tons of ore to produce 50,684 tons of concentrates yielding 18,347 ounces of gold, 691,386 ounces of silver, 567,644 pounds of copper, 9.7 million pounds of lead, and 31.5 million pounds of zinc. The grade of ore mined was considerably higher in mineral values than that mined during 1961. The increased copper content of the ore was especially noticeable. Exploration on the Iron King mine property was mainly mapping and drilling the principal ore structure extension immediately south of the present workings. The vein near and parallel to the main ore-vein system in the mine was tested further. The results of the exploratory work were inconclusive. Preparations were made for a

new system of ore extraction. The preparatory work was well advanced by yearend. The new method, expected to be in use on an entire level of the mine by mid-1963, was expected to reduce mining costs and result in other advantages.

Bagdad Copper Corp., Bagdad, stated in its annual report that copper production by the company was 22,422,539 pounds in 1962, compared with 20,933,747 pounds in 1961. The average grade of sulfide ore mined was 0.73 percent, compared with 0.71 percent in 1961 and 0.85 percent in 1960. Increased production was principally the result of increased capacity resulting from installing a sixth ball mill. Small quantities of higher grade ore were mixed with ore from the main ore body to increase the average grade of the ore sent to the mill. Although this mixing did not increase the grade of ore as much as originally forecast, the company planned to continue mixing until a better grade of ore was reached in the main ore body. Mining and milling costs, trucking, maintenance, and general mine expense per 1 pound of copper produced totaled $0.0820, compared with $0.0980 during 1961.

Production of leached copper was 6,074,357 pounds, compared with 1,005,616 pounds in 1961 when leaching began. Operating difficulties encountered after the new precipitation plant was opened were corrected. Monthly leaching production at the beginning of 1962 was approximately 235,000 and had increased to 900,000 pounds by yearend. Although the month-to-month production leveled off, the company expected production to increase slowly until the original forecast of 1 million pounds was reached. The great improvement in leaching production resulted from sprinkling leach solutions on the ore rather than by irrigation. This process gave a wider, more uniform application of the solutions and permitted a slower percolation of the solution through the ore and the leaching of more copper. The cost of leaching operations increased from $0.0176 per pound of copper produced in 1961 to $0.0298 per pound.

According to the annual report of Cyprus Mines Corp., the Copper Queen and Old Dick underground mines near Bagdad produced 111,000 short tons of ore containing 3,800 tons of copper and 7,800 tons of zinc.[11] In 1961, 95,000 tons of ore was processed. Continuing exploration of both ore bodies indicated additional ore.

American Cement Corp., Phoenix Cement Co. Division, produced portland and masonry cements at its plant near Clarksdale. Arizona Gypsum Corp. quarried a small quantity of gypsum from its plant near Camp Verde for use in agriculture and as a portland-cement retarder. The Flintkote Co., U.S. Lime Products Division, produced quicklime at its Nelson plant. A small quantity of miscellaneous clay was produced by Phoenix Cement Co. for use in portland and masonry cements. Stone production consisted mainly of crushed limestone produced by Phoenix Cement Co. and by The Flintkote Co., U.S. Lime Products Division. A small quantity of dimension sandstone was quarried by R. C. Anderson, Baily Cauchen, Dunbar Stone Co., Howard Gray, John Walker, and Hudman Quarries. Contractors for

[11] Mining World. How HMS raises grade of Old Dick's copper-zinc ore. V. 24, No. 9, August 1962, pp. 12–17.

the Arizona State Highway Department accounted for most of the sand and gravel produced in the county. The remainder was produced by two commercial operators for use in construction.

Yuma.—Sand and gravel, stone, and gem stones accounted for more than 97 percent of the total value of the county mineral production. Sand and gravel alone accounted for 72 percent of the value of nonmetals production and 70 percent of the total value. Contractors for the Bureau of Reclamation, Arizona State Highway Department, and Yuma County Highway Department furnished 859,000 tons (85 percent) of the total sand and gravel output. The balance, 153,800 tons, was produced by four commercial producers for use in construction and paving. Stone production consisted of 98,493 tons of granite used as riprap; 212 tons of dimension marble used for building stone and 2,362 tons of crushed marble used for roofing granules, ornamental stone, aggregate, and rubble; and 90,000 tons of miscellaneous stone for concrete and road metal. Gem and ornamental stones, including agate, quartz, rhodonite, geodes, gold ore, jasper, opalite, petrified wood, quartz crystals, and vanadanite, valued at $12,000, were collected.

Four placer mines produced gold and silver; and six lode mines produced ores of gold, silver, copper, lead, and zinc in the county. The aggregate value of the minerals recovered from these mines was $28,562. The Yuma Copper mine, operated by Southern California Chemical Co., and the New Chance Nos. 1–2–3 mine were the major producers of these metals.

The Mineral Industry of Arkansas

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior and the Arkansas Geological Commission, Little Rock, Ark., for collecting information on all minerals except fuels.

By Raymond B. Stroud [1]

MINERAL PRODUCTION value in Arkansas reached $153.8 million, an increase of $6 million over that of 1961. The mineral value, second highest of record, was only 4 percent under the 1960 banner year of $159.5 million (revised figure). Stone output highlighted mineral production during the year and was the largest single contributor to the overall gain in mineral values. Major gains were also recorded in production of bauxite, bromine, lime, natural gas, sand and gravel, soapstone, and zinc. Output of these mineral commodities offset value losses in production of abrasive

TABLE 1.—Mineral production in Arkansas [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite—short tons	277,855	$2,630	258,691	$2,232
Bauxite—long tons, dried equivalent	1,178,898	13,462	1,270,124	14,606
Clays—thousand short tons	773	1,758	654	1,693
Coal—do	395	2,888	256	1,809
Gem stones	(2)	19	(2)	15
Gypsum—thousand short tons	167	531	83	261
Iron ore (usable)—thousand long tons			43	296
Lime—thousand short tons	90	1,196	350	4,542
Natural gas—million cubic feet	59,547	8,039	66,213	9,866
Natural gas liquids:				
Natural gasoline and cycle products—thousand gallons	27,889	1,640	29,415	1,673
LP gases—do	75,157	3,286	69,452	2,432
Petroleum (crude)—thousand 42-gallon barrels	29,246	80,427	[3] 27,585	[3] 73,376
Sand and gravel—thousand short tons	9,389	9,074	10,847	10,006
Stone—do	12,029	12,402	20,611	19,866
Zinc (recoverable content of ores, etc.)—short tons	37	9	211	49
Value of items that cannot be disclosed: Abrasive stone, bromine, cement, and soapstone		10,906		11,063
Total		148,267		153,785

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Preliminary figure.

[1] Geologist (Mineral Deposits), Bureau of Mines, Bartlesville, Okla.

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stone, cement, barite, clays, coal, gem stones, gypsum, natural gas liquids, and petroleum. Eighteen major minerals or mineral products composed the mineral output, which included iron ore for the first time since 1958.

The economy of Arkansas continued to improve at a significant rate. Gains were recorded in expansions of manufacturing plants, agriculture, construction, employment, retail trade, and banking activities. These gains overshadowed losses in certain other segments of the economy. The mineral industry continued to contribute a significant share to the State's total personal income which rose to a record high of about $2.8 billion, an 8-percent increase. Growth of manufacturing industries consumed increasing amounts of the State's mineral production and made further adjustments toward expansion and development of the State's total economy.

Seventy-eight new manufacturing plants spent in excess of $43.6 million in capital investments in 1962; an additional 104 expansions of plants requiring expenditures of more than $49.8 million occurred in the State. Establishments classified as utilities, communications firms, and transportation companies invested more than $51.4 million for extensions and improvements of facilities. Total industry expenditures increased more than 56 percent. The mineral industry of the State received direct and indirect benefits from both new and expanded industrialization and utility expansions in the form of markets for mineral products and in improved communication, transportation, and electric and natural gas facilities.

Highway construction, Federal dam and missile projects, and residential and business building provided major markets for clay products, cement, sand and gravel, and stone. Important improvements and additions were made to the existing highway system in Arkansas. Significant progress was made in construction of three large multipurpose dams.

Construction of Greers Ferry Dam on Little Red River near Heber Springs was complete; construction of a powerhouse and related facilities was 50 percent complete at yearend. The $47 million project will provide 189 million kilowatt-hours annually. The Greers Ferry Reservoir has a storage capacity of 2.8 million acre-feet of water, of which 934,000 is for flood control and 1.9 million for power generation. The work required placing of about 856,000 cubic yards of concrete in the dam and 3,040,000 cubic yards of earth in two auxiliary dikes.

Construction of Dardanelle Dam at Dardanelle on the Arkansas River was complete at yearend and construction of the lock and powerhouse was 8 percent complete. The project provides for navigation on Arkansas River and generation of hydroelectric power. The lock facility, similar to those to be constructed at other points on the river, will be 110 feet wide and 600 feet long and will have a lift of 54 feet. Annual power output will be 636 million kilowatt-hours. In the construction 600,000 cubic yards of concrete and 218,000 cubic yards of earth and rock will be used.

Construction of Beaver Dam and of attendant facilities west of Eureka Springs on White River was 69 percent complete at yearend. Cost of the project was estimated at $46.6 million. Power facilities will be two 56,000-kilowatt-generating units. The reservoir will pro-

vide a storage capacity of 1,952,000 acre-feet, of which 300,000 acre-feet is for flood control and 1,652,000 acre-feet is for water supply and power generation. The main dam will consist of a concrete section about 1,333 feet in length and an earthfill section about 1,242 feet in length. Three embankment-type auxiliary dams will be across valleys on the rim of the reservoir. The structures will contain about 779,000 cubic yards of concrete and 1,610,000 cubic yards of earth and rock.

Construction of access roads continued at the site of Millwood Dam, 8 miles east of Ashdown on Little River. A part of the earthfill structure was constructed which, when completed, will be about 17,500 feet in length. The dam will create a reservoir having a capacity of 1,858,000 acre-feet of water. Through December 1962, the overall project was approximately 10 percent complete. Total cost of the project was estimated at $55.7 million.

Construction of access roads and of a service area began near the site of De Gray Reservoir, 7 miles northwest of Arkadelphia on Caddo River. The dam structure will be 3,040 feet long and 243 feet high above the streambed. A powerplant consisting of one 40,000-kilowatt conventional-type and one 28,000-kilowatt reversible-type generating unit will be installed. The water-supply feature will provide a minimum of 250 million gallons per day in Caddo River below the dam for municipal and industrial use.

The U.S. Army Corps of Engineers continued levee construction, bank stabilization, and channel rectification programs at several points in Arkansas, thereby creating navigable waterways and providing protection against flooding. These projects consumed earth, sand and gravel, and stone and provided substantial markets for these mineral commodities. The Corps also continued work on installation of 2 additional 45,000-kilowatt-generating units at Bull Shoals Dam. Upon completion, the project will have a total capacity of 340,000 kilowatts.

Arkansas Cement Corp. completed additions at a cost of $7.5 million, which doubled capacity of its cement plant at Foreman to 2.8 million barrels annually. New facilities included a second 12- by 450-foot kiln, a ball mill, and related equipment. The corporation also completed a new 50,000 barrel distributing terminal in Memphis, Tenn., at a cost of $500,000. The company has another distribution terminal under construction at Oklahoma City.

In August, A. P. Green Fire Brick Co. began construction of a new clay calcining plant near Berger just southwest of Little Rock. The new plant was scheduled for completion shortly after the first of January 1963. Facilities at the property were to include offices, ore stockpiling housing, an 8- by 140-foot calcining kiln, and a 3- by 42-foot air-quenching cooler. The new plant will enable the company to calcine bauxite and kaolin more efficiently and provide for better quality end products.

Dierks Forests, Inc., began construction of a new wallboard manufacturing plant 9 miles north of Nashville, Howard County, about midyear. The cost of plant construction would exceed $1.5 million and capacity would approach 400,000 square feet of half-inch wallboard on a daily basis. The company planned to utilize gypsum mined from properties adjacent to the plant site.

Southwest Enterprises, Inc., began mining and washing iron ore at a rate of 600 tons daily in April 1962. The company had several hundred acres under lease and conducted sufficient exploration projects to block out large iron ore reserves. The washing-plant product was marketed to a steel producer in Birmingham, Ala., and to cement manufacturers in Arkansas and adjacent States.

Arkansas Power and Light Co. completed the 30-mile, 115,000-volt Stuttgart-De Witt-Gillett transmission line to provide for future growth of consumption of electric power in the area. Reconstruction of a 66-mile, 115,000-volt transmission line between Pine Bluff and Camden was scheduled for completion in 1963. Preliminary work began on a new substation at Mountain View, Stone County. The company will build a 20-mile, 161,000-volt line to serve the substation. Construction of other substations continued at Glendale, Hamburg, West Helena, Little Rock, El Dorado, and Strong. Distribution projects were carried out at several points in the State and electric power was provided to 18 Titan Missile Bases in central Arkansas. The power company provides service directly and indirectly to many mineral producers in Arkansas.

Arkansas Electric Co-operative Corp., which provides REA electric power in Arkansas, continued construction of the Thomas B. Fitzhugh steam-generating plant on the Arkansas River near Ozark. The plant will have a capacity of 57,000 kilowatts and is expected to be completed by March 1963. The electric facility will use up to 42,000 gallons of river water per minute to cool water from the boiler. Boiler water will be obtained from two deep wells. The boiler will be gas fired and is expected to consume $40,000 worth of natural gas monthly. The boiler was constructed so that coal-burning facilities could be installed if coal delivered by river barge became cheaper than natural gas in future operation of the plant.

Arkansas Electric Co-operative Corp. secured a $22.5 million loan from Rural Electrification Administration to construct a 100,000-kilowatt steam generating plant in the vicinity of Augusta, Woodruff County. The boiler will be fired with natural gas. The corporation also will construct 630 miles of transmission lines to serve 30 counties in central Arkansas. Plans for construction, selection of the site, and starting date were being finalized at yearend.

Employment and Injuries.—Although there was an overall increase in mineral production, average annual employment dropped 6 percent. Employment in metal mining diminished about 9 percent; in bituminous coal mining, about 32 percent; and in crude petroleum and natural gas production, about 10 percent. Employment in mining and quarrying of nonmetallic minerals increased about 7 percent. The mining industry payroll was about $25.1 million, nearly 3 percent lower than that of 1961.

Average weekly wages were: Metal industry, $115.93, a 3-percent increase; coal industry, $85.46, a 14-percent decrease; crude petroleum and natural gas industry, $96.95, a 3-percent increase; and nonmetallic mining and quarrying industries, $84.50, a 6-percent increase.

Available data indicate that three fatalities occurred in mining in 1962: One was in metallic mining, and two were in nonmetallic min-

ing. No fatal accidents occurred in coal mines, but 21 nonfatal accidents were recorded. Injury data pertinent to the petroleum industry were not available.

TABLE 2.—Average annual employment for selected mineral industries

Industry	1961		1962	
	Employing units	Employment	Employing units	Employmnte
Metal mining	24	647	19	592
Bituminous coal mining	21	248	20	168
Crude petroleum and natural gas	386	2,987	382	2,703
Nonmetalic mining and quarrying	106	1,523	114	1,623
Total	537	5,405	535	5,086

Source: Arkansas Department of Labor, Employment Security Division, Little Rock, Ark.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Petroleum, natural gas, natural gas liquids, and coal accounted for the largest segment of the aggregate value of Arkansas mineral production. Total value of the four commodities amounted to $89.2 million, about 8 percent less than the 1961 value. The decline in the aggregate value of coal, natural gas liquids, and petroleum offset a major increase in the value of natural gas output.

Coal (Bituminous).—Total coal production decreased 35 percent, and value declined 37 percent compared with 1961. The sharp drop in production was attributed largely to increased competition from other coal-producing States, the lowered rate of steel production, and other fuels. Two large coal-producing companies, ceasing operations late in 1961 and early in 1962, had accounted for about 100,000 tons of the coal output. During the year, 16 mines consisting of 9 underground and 7 strip-mine operations produced 1,000 tons or more of coal. Open-pit mines accounted for 65 percent of the production; the balance was from underground operations. Underground production decreased 45 percent, and strip-mine production decreased 28 percent. Five counties contributed to the State's total coal output; these were, in order of tonnage and value, Johnson, Franklin, Sebastian, Logan, and Pope.

Oil and Gas Exploration and Development.—A total of 117 oil wells and 36 gas wells resulted from drilling activity in 25 counties. There

TABLE 3.—Coal production [1]

(Thousand short tons and thousand dollars)

Year	Short tons	Value	Year	Short tons	Value
1953–57 (average)	586	$4,526	1960	409	$3,116
1958	364	2,744	1961	395	2,888
1959	441	3,482	1962	256	1,809

[1] Data from mines producing 1,000 tons or more.

were 187 wells classified as dry holes. Drilling activities declined and the total number of holes drilled was 31 percent under the 1961 level. The number of development and exploratory wells drilled in Calhoun, Lafayette, Miller, and Union Counties dropped sharply. Drilling activities increased significantly in Bradley, Nevada, and Ouachita Counties. Petroleum and natural gas companies spent 244 crew-weeks exploring for oil and gas in the State, utilizing seismographic and gravity-meter techniques. The geophysical work was done in seven south Arkansas counties and in seven north Arkansas counties.

Less than 45 percent of the wells drilled produced oil and gas, compared with 50-percent success ratio in 1961. More successful wells were drilled in north Arkansas than in previous years, establishing a new success record for the area. Exploratory drilling completed 10 new sources of supply: 8 new fields, consisting of 3 oil and 5 gas fields, and 2 new gas pools. In addition, 11 new pools were discovered by field development wells. Outpost wells were successful in delineating lateral extensions in 12 fields.

TABLE 4.—Oil and gas well drilling in 1962, by counties

County	Drilling						Total
	Proved field wells			Exploratory wells			
	Oil	Gas	Dry	Oil	Gas	Dry	
Bradley	6	1				6	13
Calhoun	1					5	6
Chicot						1	1
Clark						1	1
Cleburne			1				1
Columbia	2		2			6	10
Conway						1	1
Crawford		4				1	5
Desha						1	1
Faulkner						1	1
Franklin		16	2			2	20
Hempstead						2	2
Johnson		1	1		1	1	4
Lafayette	11		18			18	47
Logan			2			4	6
Miller	12		10			10	32
Nevada	1		3			7	11
Ouachita	38		7			8	53
Pope		2	3		1	2	8
Sebastian		7	2		3	1	13
Scott						1	1
Union	45		35	1		17	98
Van Buren						1	1
White						2	2
Yell						2	2
Total: 1962	116	31	86	1	5	101	340
1961	197	40	147	6	2	101	493

Source: Arkansas Oil and Gas Statistical Bulletin, v. 22, No. 12, December 1961 through v. 23, No. 5, May 1963.

The deepest well drilled was in Lafayette County and was abandoned as a Smackover lime failure; total depth was recorded as 12,000 feet. The producing depth record was a gas-condensate producer at 11,005 to 11,025 feet in the Smackover lime.

Dry natural gas was produced from relatively shallow sands of Pennsylvanian and Mississippian ages and from deeper pay zones of Devonian age in Northern Arkansas. Five new gasfields and seven new sources of supply were found by drilling operations. At yearend, there were 60 gasfields in north Arkansas; however, 11 gasfields had not been connected to pipeline outlets.

Oil and natural gas production came from Cretaceous and Jurassic formations in south Arkansas. Three oilfields and five gas pools were discovered by exploratory and development drilling. Several lateral extensions were discovered by successful outpost wells. Six new waterflood projects were started during the year. Out of a total of 179 fields that produced oil, condensate, or gas, 133 fields were in south Arkansas.

Pipeline Construction.—In April, Arkansas Western Gas Co. announced plans for constructing a 12-mile, 12¾-inch pipeline in Madison and Washington Counties. The new line would parallel an existing 8-inch line and provide up to 68.5 million cubic feet of natural gas daily. A greater demand for natural gas in the area has been created by industrial growth and by a population increase. Construction costs were estimated at $318,636.

Arkansas-Louisiana Gas Co. filed an application in March with the Federal Power Commission to construct a $41 million natural gas pipeline extending from Centrahoma, Okla., across north Arkansas to Jonesboro, thence southward to Helena. The project would be accomplished in three stages: (1) A combination 8- to 24-inch line would be laid from Centrahoma to Paris, a distance of about 158 miles, and the line would provide an outlet for about 3 trillion cubic feet of gas reserves in the Centrahoma, Red Oak, West Wilburton, Spiro, Savanna, Carterville, Milton, and other gasfields in Oklahoma, as well as gasfields such as Gregg gasfield in western Arkansas; (2) a high-pressure, 180-mile line would then be laid from Paris to Jonesboro and this line would tap gasfields in Johnson, Pope, and Conway Counties; (3) the final phase would consist of constructing a 90-mile high-pressure line from Jonesboro to Helena, and connecting it to a relatively new line already serving the area. The proposed lines would offer markets for producers of natural gas in eastern Oklahoma,

TABLE 5.—Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

	Proved reserves Dec. 31, 1961	Changes in proved reserves, due to extensions and new discoveries in 1962	Proved reserves Dec. 31, 1962 (production was deducted)	Change from 1961, percent
Crude oil—thousand barrels	280,689	−6,984	246,795	−12
Natural gas liquids[1]—do	22,233	−92	19,744	−11
Natural gas—million cubic feet	1,476,992	248,621	1,652,645	+12

[1] Includes condensate, natural gasoline, and LP gases.

Source: American Gas Association, and American Petroleum Institute and Canadian Petroleum Association. Proved Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas. V. 17, Dec. 31, 1962, pp. 11-12, 21.

Arkansas Valley, and north Arkansas and would provide interconnected service to many industrial and domestic markets.

Natural Gas.—Natural gas production continued an upward trend for the sixth consecutive year. Value of natural gas produced increased 23 percent, and quantity produced increased 11 percent. Of 15 counties reporting gas production, 9 counties in northern Arkansas accounted for 73 percent of the total value. Value of the natural gas production in 6 southern Arkansas counties remained near the $25 million mark, thus indicating that the increased production was attributable to north Arkansas. Franklin County in northern Arkansas led the State in natural gas production. Columbia, Lafayette, Pope, and Sebastian Counties ranked among the leading gas-producing counties; Columbia led in output in southern Arkansas.

Natural Gas Liquids.—Aggregate value and quantity of natural gas liquids decreased 17 and 4 percent, respectively. A 2-percent increase in value of natural gasoline and cycle products was not sufficient to offset a major decrease in total value of LP gas output. Five natural gasoline plants, compared with four in 1961, and one cycling plant were operated in 1962. Austral Oil Co., Inc., began operation at Lake Erling plant in Lafayette County.

Petroleum.—Crude petroleum production continued to lead in value among mineral commodities produced; however, output and value

TABLE 6.—Gross withdrawals and disposition of natural gas

(Million cubic feet)

Year	Gross withdrawals [1]			Disposition			
	From gas wells	From oil wells	Total	Marketed production [2]		Repressuring	Vented and wasted [3]
				Quantity	Value (thousands)		
1953–57 (average)	25,420	31,200	56,620	33,719	$1,981	17,507	5,395
1958	23,000	45,000	68,000	32,890	2,664	28,180	6,930
1959	32,000	40,800	72,800	40,674	3,539	27,488	4,638
1960	45,700	41,100	86,800	55,451	6,599	27,640	3,709
1961	45,800	42,100	87,900	59,547	8,039	25,748	2,605
1962	62,000	41,600	103,600	66,213	9,866	35,315	2,072

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Compromises gas sold or consumed by producers, including losses in transmission, quantities added to storage, and increases in gas in pipelines.
[3] Included direct waste on producing properties and residue blown to air.

TABLE 7.—Natural gas liquids production

(Thousand gallons and thousand dollars)

Year	Natural gasoline and cycle products		LP gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	47,616	$3,090	56,193	$2,328	103,809	$5,418
1958	37,197	2,574	53,518	2,743	90,715	5,317
1959	40,730	2,523	55,731	3,048	96,461	5,571
1960	34,558	2,148	73,252	3,735	107,810	5,883
1961	27,889	1,640	75,157	3,286	103,046	4,926
1962	29,415	1,673	69,452	2,432	98,867	4,105

declined 6 and 9 percent, respectively. At yearend, 5,918 oil wells were producing in the State. Magnolia oilfield in Columbia County led in production with 6.3 million barrels. Eight counties recorded oil production; Columbia, Union, Lafayette, and Ouachita Counties accounted for 91 percent of the total value. About 50 percent of the production was from unitized secondary recovery projects.

TABLE 8.—Crude petroleum production, by fields

(Thousand barrels and thousand dollars)

Field [1]	1961		1962 [2]	
	Barrels	Value	Barrels	Value
Dorcheat-Macedonia	603	$1,658	518	$1,378
El Dorado	597	1,642	471	1,253
Fouke	1,074	2,954	1,067	2,838
Magnolia	5,493	15,106	6,334	16,848
McKamie	1,387	3,814	1,836	4,884
Midway	2,208	6,072	2,106	5,602
Schuler	1,725	4,744	1,661	4,418
Smackover	3,267	8,984	3,161	8,408
Stephens	1,108	3,047	1,064	2,830
Village	529	1,455	498	1,325
Wesson	1,539	4,232	1,381	3,673
Other fields [3] [4]	9,716	26,719	7,488	19,919
Total	29,246	80,427	27,585	73,376

[1] Breakdown of individual fields as reported in the Oil and Gas Journal.
[2] Preliminary figures.
[3] Includes oil consumed on leases and net change in stocks held on leases for the State.
[4] Bureau of Mines figures.

TABLE 9.—Crude petroleum production, indicated demand, and stocks in 1962, by months

(Thousand barrels)

Month	Production	Indicated demand	Stocks originating in Arkansas	Month	Production	Indicated demand	Stocks originating in Arkansas
January	2,342	2,233	1,867	August	2,309	2,809	1,195
February	2,193	2,214	1,846	September	2,190	2,096	1,289
March	2,358	2,502	1,702	October	2,335	2,378	1,246
April	2,298	2,350	1,650	November	2,259	2,271	1,234
May	2,380	2,379	1,651	December	2,307	2,325	1,216
June	2,285	2,255	1,681				
July	2,329	2,315	1,695	Total	27,585	28,127	----

NONMETALS

Nonmetallic mineral production contributed 32 percent of the total value of the State's mineral output, representing an increase of 29 percent over that of 1961. Sales, mine shipments, or marketable production were recorded for stone, cement, sand and gravel, lime, barite, clays, bromine, gypsum, soapstone, abrasive stone, and gem stones.

Abrasive Stone.—Rough, unfinished novaculite, quarried in Garland County, was processed into oilstones and whetstones. Quantity declined 31 percent and value was 18 percent lower than in 1961. Three companies—Norton Pike, Arkansas Oilstone, and Jackson Whetstone—accounted for the novaculite output.

Barite.—Barite output decreased about 7 percent in quantity and 15 percent in value. Arkansas ranked second in production of barite in the United States in 1962, relinquishing the number one position to Missouri for the first time since 1944. Continued decline in oil and gas well drilling, which consumes most of the barite output, and competition from foreign imports contributed to lower production.

TABLE 10.—Primary barite sold or used by producers

Year	Short tons	Value (thousands)	Year	Short tons	Value (thousands)
1953–57 (average)	435,590	$3,996	1960	277,851	$2,578
1958	182,779	1,668	1961	277,855	2,630
1959	338,539	3,097	1962	258,691	2,232

Bromine.—Production and value of bromine reached a record high. Bromine was recovered from brines associated with oilfields in south Arkansas. Two companies, Michigan Chemical Corp. and Arkansas Chemicals, Inc., had a combined plant capacity of 40 million pounds.

Bromine production was converted to ethylene dibromide for use as a gasoline additive; other quantities were used to manufacture fumigants for the agricultural industry and in making fire-retardant compounds.

Cement.—A slight increase was recorded in production of portland and masonry cement at the State's two plants, but value, based upon shipments, decreased significantly. State and Federal construction projects and residential building continued at a record pace. Arkansas Cement Corp. completed construction of plant facilities increasing annual plant capacity to 2.8 million barrels at Foreman.

TABLE 11.—Shipments of portland cement to Arkansas consumers

Year	Arkansas (thousand barrels)	Change, percent	
		In Arkansas	In United States
1953–57 (average)	1,945		
1958	2,129	+26	+6
1959	2,624	+23	+9
1960	2,590	−1	−7
1961	2,968	+15	+3
1962	3,053	+3	+3

Clays.—Arkansas clay production decreased 15 percent, resulting in a decline of 4 percent in value. Major quantities of clay were consumed in making refractories, face brick, sewer pipe, building brick, and heavy clay products. The lightweight aggregate and cement industries consumed significant quantities of clay. Twenty companies produced clay from 14 counties. Hot Spring County ranked first in clay output, followed by Pulaski and Sebastian Counties.

Gem Stones.—Output of gem stones and mineral specimens dropped sharply for the second consecutive year. Value of diamonds found

TABLE 12.—Clays sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Miscellaneous clay [1]		Fire clay		Total clay	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	267	$346	377	$1,632	644	$1,978
1958	265	264	313	1,313	578	1,577
1959	383	383	399	2,023	782	2,406
1960	388	387	427	2,069	815	2,456
1961	434	428	339	1,330	773	1,758
1962	368	365	286	1,328	654	1,693

[1] Includes clay used for cement.

in Pike County contributed the largest share of the aggregate value. Quartz crystals and wavellite were recovered in Garland and Montgomery Counties and sold as mineral specimens.

Gypsum.—Output and value of gypsum declined about 50 percent. Dulin Bauxite Co., the only producer, quarried and processed gypsum at Highland, Pike County, for use as a retarder in portland cement. Dierks Forests, Inc., began exploration and development of gypsum deposits about 9 miles north of Nashville, Howard County. The company also began construction of a wallboard plant at a site adjacent to the gypsum deposits. The deposits are a westward extension of the gypsum beds mined at Highland by Dulin Bauxite Co. The beds range from 2 to 12 feet in thickness and occur in the DeQueen limestone member of the Upper Trinity formation of Cretaceous age. Reserves of gypsum are estimated to be several million tons.

Lime.—A major increase in lime output occurred during the year. Value of the commodity increased at a commensurate rate. Seven companies reported lime production, including regenerated lime, which was consumed largely in paper, aluminum, and chemical industries. Other quantities of lime were used in the petroleum industry, for sugar refining and water purification purposes, and in certain agricultural and building applications. Five counties recorded lime production; Saline County led in output.

Sand and Gravel.—The continued high rate of building and construction activities in Arkansas resulted in a 16-percent gain in sand and gravel output with an attendant value increase of 10 percent. A total of 169 operators produced sand and gravel from 50 of the State's 75 counties. Average unit value of sand and gravel supplied for State and Federal construction projects was 50 cents per ton; commercial sand and gravel brought an average of $1.18 per ton.

Soapstone.—Production and value of soapstone increased 27 percent. The soapstone is associated with serpentine rock in northern Saline County. Ground soapstone is used as a filler in insecticides, roofing, and rubber compounds.

TABLE 13.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953-57 (average)	5,186	$4,990	2,678	$1,983	7,864	$6,973
1958	6,256	5,719	2,388	1,321	8,644	7,040
1959	6,973	7,535	4,723	4,322	11,696	11,857
1960	5,935	6,732	2,257	3,530	8,192	10,262
1961	5,933	6,892	3,456	2,182	9,389	9,074
1962	6,717	7,946	4,130	2,060	10,847	10,006

TABLE 14.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,350	$1,459	1,346	$1,434
Paving	959	906	946	891
Fill	(1)	(1)	247	135
Other [2]	570	1,104	325	1,002
Total	2,879	3,469	2,864	3,462
Gravel:				
Building	1,214	1,728	1,496	2,215
Paving	1,717	1,604	2,220	2,188
Fill	57	28	86	42
Other [3]	66	63	51	39
Total	3,054	3,423	3,853	4,484
Total sand and gravel	5,933	6,892	6,717	7,946
Government-and-contractor operations:				
Sand:				
Building	----	----	2	3
Paving	1,978	787	1,837	896
Total	1,978	787	1,839	899
Gravel:				
Paving	1,407	1,363	2,051	1,058
Fill	71	32	240	103
Total	1,478	1,395	2,291	1,161
Total sand and gravel	3,456	2,182	4,130	2,060
Grand total	9,389	9,074	10,847	10,006

[1] Figure withheld to avoid disclosing individual company cofidential data, included with "Other."
[2] Includes fill (1961) glass, molding, and other construction, industrial, and ground sand.
[3] Includes railroad ballast, miscellaneous gravel, and other construction gravel.

Stone.—Stone output set a new record in 1962 and ranked second in value among mineral commodities produced. The major part of the increase was attributable to crushed sandstone production; significant gains also were recorded in output of syenite and crushed limestone. Highway construction projects and river basin development programs were principal markets for the stone. Dimension sandstone, dimension and crushed marble, slate, limestone for cement and lime, and syenite for roofing granules were other products of the

TABLE 15.—Sand and gravel production in 1962, by counties

County	Short tons	Value	County	Short tons	Value
Ashley	168,479	$197,336	Little River	30,150	$22,613
Benton	39,286	33,111	Logan	27,000	30,000
Boone	24,135	18,101	Marion	23,196	16,000
Bradley	85,622	66,234	Mississippi	40,500	45,000
Calhoun	280,620	348,286	Montgomery	38,361	28,771
Carroll	244,657	155,803	Nevada	3,293	3,022
Clark	54,724	45,175	Ouachita	399,685	277,058
Clay	77,880	72,545	Pike	5,581	4,186
Cleveland	16,553	12,415	Pulaski	560,829	564,409
Craighead	78,353	89,388	St. Francis	244,096	196,031
Drew	97,729	39,092	Saline	34,335	49,356
Garland	47,750	139,983	Searcy	124,076	93,058
Greene	165,834	120,879	Woodruff	10,149	7,612
Hempstead	30,193	18,116	Yell	905	905
Howard	4,144	3,108	Other Counties [1]	7,439,826	6,292,323
Izard	292,859	862,351			
Lawrence	41,848	41,470	Total	10,847,319	10,005,790
Lincoln	114,675	112,053			

[1] Includes Chicot, Cleburne, Conway, Crawford, Cross, Desha, Hot Spring, Independence, Jackson, Jefferson, Johnson, Lafayette, Miller, Phillips, Poinsett, Pope, Sebastian, Sevier, and undistributed amounts from various counties, combined to avoid disclosing individual company confidential data.

State's stone mining industry. Production of stone for commercial uses accounted for about 58 percent of total tonnage and 64 percent of total value.

Value per ton of commercial stone averaged $1.05, and value of Government-and-contractor stone averaged $0.84 per ton, compared with values of $1.07 and $0.91, respectively, for 1961.

TABLE 16.—Stone sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1958	8,461	$10,178	1961	12,029	$12,402
1959	8,824	10,424	1962	20,611	19,866
1960	10,939	13,555			

Sulfur (Recovered Elemental).—Production of byproduct sulfur at gas-cycle plants in Columbia, Lafayette, and Union Counties was continued. Tonnage of sulfur shipments decreased 3 percent, and value was 24 percent lower than comparable 1961 data. Most of the sulfur was produced in Lafayette County. The plant recovers about 97 percent of the sulfur from sour natural gas, utilizing the modified Claus sulfur recovery process.

METALS

Production of metallic minerals (bauxite, iron, zinc) comprised the smallest segment of the total mineral output in terms of value.

Aluminum.—Production of primary aluminum increased 27 percent over the 1961 output. The industry continued to compete with imported aluminum metal and metal products. The two aluminum reduction plants operated at about 50-percent capacity for the last 9 months of 1962, compared with 30-percent and 40-percent capacity operations, respectively, during the first 3 months of the year.

Bauxite.—A gain of 8 percent was recorded in production and value of bauxite. Part of the gain was attributed to increased aluminum output, but demands for calcined bauxite and bauxite used in manufacturing chemicals accounted for a significant part of the increase. Production of bauxite from Arkansas accounted for 93 percent of all U.S. output.

Reynolds Mining Corp., with open-pit and underground mines in Saline and Pulaski Counties, was the leading bauxite producer. Aluminum Company of America, with strip mining in Saline County, ranked second.

TABLE 17.—Bauxite mine production and shipments from mines and processing plants to consumers

(Thousand long tons and thousand dollars)

Year	Mine production			Shipments		
	Crude	Dry equivalent	Value	As shipped	Dry equivalent	Value
1953–57 (average)	1,948	1,646	$13,951	1,926	1,665	$15,249
1958	1,517	1,258	12,311	1,588	1,348	14,373
1959	1,940	1,631	17,048	1,827	1,580	17,960
1960	2,327	1,932	20,469	1,876	1,603	18,982
1961	1,419	1,179	13,462	1,244	1,080	13,220
1962	1,523	1,270	14,606	1,715	1,481	17,535

Iron Ore.—Production of iron ore was recorded for the first time since 1958. Southwest Enterprises, Inc., began exploration and development of iron-ore deposits in Nevada and Lafayette Counties early in 1962. The activities were later concentrated near Falcon, Nevada County, where a washing plant with a daily capacity of 600 tons was placed in operation. The company had considerable acreage under lease and development at yearend. The company marketed coarse iron-ore concentrates to a steel manufacturer in Alabama; fine concentrates were sold for use in cement manufacturing in Arkansas, Oklahoma, and Louisiana plants.

Zinc.—Athletic Mining and Smelting Co. operated the Fort Smith zinc smelter at about 40-percent capacity throughout 1962. Rush Creek Mining and Exploration Co. remodeled its mill in Marion County and reported output of zinc concentrates at about five times that recorded in 1961. The company mined zinc ores from properties adjacent to the mill site.

REVIEW BY COUNTIES

Production of minerals was recorded in 65 of the State's 75 counties, as compared with 67 counties in 1961. Gains in mineral values were reported in 32 counties and decreases were noted in 37 counties, as compared with 1961 data. Twenty counties reported mineral values exceeding $1 million. Petroleum was produced in 8 counties; natural gas in 15; natural gas liquids in 3; clay in 14; coal in 5; sand and gravel in 50; stone in 33; lime in 4; gem stones and recovered sulfur in 3; barite, bauxite, slate, and cement in 2; and abrasive stone, bromine, gypsum, iron, soapstone, and zinc each in 1. Five counties—

TABLE 18.—Value of mineral production in Arkansas, by counties[1]

County	1961[2]	1962	Minerals produced in 1962 in order of value
Ashley	$136,651	$262,225	Sand and gravel, lime.
Baxter	72,106	11,226	Stone.
Benton	278,598	(3)	Stone, sand and gravel.
Boone	37,832	77,775	Do.
Bradley	506,448	449,172	Petroleum, sand and gravel.
Calhoun	1,652,950	1,076,377	Do.
Carroll	470,099	2,338,831	Stone, sand and gravel.
Chicot	66,110	(3)	Sand and gravel.
Clark	30,314	57,161	Sand and gravel, stone, clays.
Clay	9,842	72,545	Sand and gravel.
Cleburne	1,267,528	517,619	Stone, sand and gravel, natural gas.
Cleveland	52,316	12,415	Sand and gravel.
Columbia	32,155,563	31,424,844	Petroleum, natural gas liquids, natural gas.
Conway	409,696	888,088	Stone, natural gas, sand and gravel.
Craighead	203,932	98,688	Sand and gravel, clays.
Crawford	985,023	1,913,159	Stone, natural gas, sand and gravel.
Crittenden	69,691		
Cross	221,645	(3)	Sand and gravel.
Dallas	1,035		
Desha	405,276	(3)	Sand and gravel.
Drew	29,428	39,092	Do.
Faulkner	77,552	468,589	Stone.
Franklin	3,587,012	4,569,012	Natural gas, coal.
Garland	171,327	179,855	Sand and gravel, abrasive stone, gem stones.
Greene	313,898	120,879	Sand and gravel.
Hempstead	43,439	39,004	Clays, sand and gravel.
Hot Spring	3,850,235	3,565,435	Barite, clays, stone, sand and gravel.
Howard	(3)	(3)	Cement, stone, clays, sand and gravel.
Independence	1,278,341	(3)	Stone, lime, sand and gravel.
Izard	(3)	(3)	Stone, sand and gravel.
Jackson	(3)	(3)	Sand and gravel, stone.
Jefferson	(3)	(3)	Lime, sand and gravel.
Johnson	1,418,038	1,385,733	Coal, natural gas, sand and gravel, clays, stone.
Lafayette	17,231,274	16,327,637	Petroleum, natural gas liquids, natural gas, sand and gravel.
Lawrence	365,439	991,075	Stone, sand and gravel.
Lincoln	117,758	112,053	Sand and gravel.
Little River	(3)	(3)	Cement, stone, clays, sand and gravel.
Logan	1,066,990	882,594	Natural gas, stone, coal, sand and gravel.
Lonoke	203,892	75,732	Clays, stone.
Madison	462,815	(3)	Stone.
Marion	31,441	86,436	Zinc, stone, sand and gravel.
Miller	6,353,527	5,293,667	Petroleum, sand and gravel, natural gas, clays.
Mississippi	(3)	45,000	Sand and gravel.
Monroe	47,873		
Montgomery	698,701	(3)	Slate, sand and gravel, gem stones, barite.
Nevada	1,503,701	1,734,281	Petroleum, iron ore, sand and gravel, natural gas.
Ouachita	11,684,351	9,697,032	Petroleum, sand and gravel, natural gas, clays.
Perry	182,833	248,169	Stone.
Phillips	26,028	(3)	Sand and gravel.
Pike	573,086	274,333	Gypsum, gem stones, sand and gravel.
Poinsett	178,344	(3)	Sand and gravel.
Polk	33,407	19,104	Clays.
Pope	1,647,371	1,344,903	Natural gas, stone, sand and gravel, coal.
Pulaski	5,070,946	7,347,367	Stone, clays, sand and gravel, bauxite.
Randolph	18,834	67,645	Stone.
St. Francis	(3)	196,031	Sand and gravel.
Saline	13,507,858	17,903,667	Bauxite, lime, soapstone, sand and gravel, slate.
Scott	108,562		
Searcy	79,628	100,499	Sand and gravel, stone.
Sebastian	1,572,135	1,914,000	Stone, natural gas, coal, sand and gravel, clays.
Sevier	108,352	(3)	Sand and gravel.
Sharp		38,000	Stone.
Stone		24,267	Do.
Union	20,099,322	18,364,983	Petroleum, bromine, natural gas, natural gas liquids, clays.
Van Buren	8,128	12,147	Stone.
Washington	290,218	328,231	Stone, natural gas.
White	(3)	(3)	Stone.
Woodruff	11,914	7,612	Sand and gravel.
Yell	299,128	(3)	Stone, sand and gravel.
Undistributed	14,881,219	20,780,811	
Total	148,267,000	153,785,000	

[1] The following counties are not listed because no production was reported in 1961 or 1962: Arkansas, Fulton, Grant, Lee, Newton, and Prairie.
[2] Revised figures.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Columbia, Union, Saline, Lafayette, and Ouachita—contributed 61 percent of the aggregate value of the State's mineral output. Only those counties with significant production are discussed in this review.

Ashley.—Combined value of sand and gravel and lime was nearly double that reported in 1961. Crossett Paper Mills produced lime for use in paper manufacture at Crossett. Sand and gravel for use in building and road construction was produced by three companies.

Benton.—Paul Davis and White River Sand and Gravel Co. mined and processed sand and gravel for building, paving, and fill. Independent Gravel Co. and Ozark Construction, Inc., quarried limestone for use as a concrete aggregate, roadstone, glass manufacture, and other purposes.

Bradley.—Aggregate value of petroleum and sand and gravel production decreased 11 percent compared with 1961. O'Neil Brothers and Moro Gravel Co. accounted for the sand and gravel output. All development well drilling was successful in discovering oil and/or gas; all exploratory well drilling projects resulted in dry holes.

Calhoun.—Mineral production, consisting of petroleum and sand and gravel, decreased 35 percent compared with 1961. The major part of the decrease was attributable to a substantial drop in sand and gravel output. Ouachita Aggregate Co., W. W. Grant, St. Francis Material Co., and Reynolds and Williams accounted for the major part of the sand and gravel production. Only one producing field well was drilled during the year.

Carroll.—Value of the county's mineral output increased fourfold. Production of stone for riprap and concrete aggregate used in construction of Beaver Dam accounted for most of the gain; value of sand and gravel output was more than twice that reported in 1961. Garrett Gravel Co. supplied sand and gravel for building and construction.

Chicot.—Greenville Gravel Co. recovered and processed sand and gravel for use in building and other construction.

Cleburne.—Production of natural gas and stone decreased significantly and accounted for a 59 percent decrease in overall value of mineral output. Southeast Construction Co. reported a large increase in sand and gravel production. Completion of Greers Ferry Dam near Heber Springs accounted for the drop in stone output.

Columbia.—Mineral production consisted entirely of petroleum, natural gas liquids, and natural gas. Aggregate value decreased 2 percent but the county remained the leader in overall mineral value, ranked first in production of petroleum and natural gas liquids, and ranked second in natural gas output. Arkla Chemical Corp. continued full-scale operation of its gas-processing plant; production included LP gases, natural gasoline and cycle products, and sulfur. Two successful field wells were completed.

Conway.—Output of stone, natural gas, and sand and gravel—ranked by value—was sufficient to more than double the value of mineral production reported in 1961. The larger part of the increase was attributed to increased production of stone used for highway construction and river stabilization projects.

Craighead.—Value of mineral production decreased sharply, largely because of completion of highway construction projects which con-

sumed major quantities of sand and gravel in 1961. Wheeler Brick Co., Inc., increased its production of clay for face brick by 39 percent.

Crawford.—Total value of stone, natural gas, and sand and gravel, comprising all of the mineral output, increased 94 percent. Major gains were recorded in stone and natural gas output. Arkhola Sand & Gravel Co. accounted for most of the sand and gravel output. Ben M. Hogan & Co., Mid-Continent Stone & Construction Co., and Arkhola Sand & Gravel Co. quarried and crushed sandstone for use as riprap, concrete aggregate, and roadstone. Four new gas wells increased the county's reserves of natural gas; production of natural gas was nearly doubled.

Faulkner.—U.S. Army Corps of Engineers continued bank stabilization programs along Arkansas River resulting in a large increase in crushed sandstone production. Various private contractors working in conjunction with the U.S. Army Corps of Engineers reported a gain in sandstone output more than six times that recorded in 1961.

Franklin.—Production of natural gas increased significantly, and total mineral value increased 27 percent. The county continued to lead in natural gas output. Coal, strip-mined by Quality Excelsior Coal Co., was the only other mineral commodity produced in the county.

Garland.—Production of sand and gravel, abrasive stone (novaculite), and gem stones had a total value that increased slightly. Sand and gravel mined on the outskirts of the county was washed and processed by Smith Bros. Construction Co. and used for building construction. Norton Pike Co., Arkansas Oilstone Co., and Jackson Whetstone Co. quarried novaculite for processing into oilstones and whetstones. Malvern Minerals Co. furnished ground silica sand for grinding applications in finishing small cast-metal parts. Quartz crystals and specimen-type novaculite were gathered and sold by Charles Coleman, Garmon Rocks and Minerals, and Garland Milholen.

Hot Spring.—Barite continued to be the most important mineral produced in the county. Baroid Division of National Lead Co. and Magnet Cove Barium Corp. mined and ground barite for use in oil-well drilling muds. Hot Spring County ranked second in clay production. The Perla Plant, Acme Brick Co., and Malvern Brick and Tile Co., processed fire clay for refractories and heavy clay products; Malvern Plant, Acme Brick Co., manufactured building brick and tile. Sand and gravel for building and paving uses were mined and processed by Malvern Gravel Co. and Ouachita Sand and Gravel Co. Miscellaneous stone, principally novaculite, was quarried and crushed by Malvern Gravel Co., Coogan Gravel Co., and Harbison-Walker Refractories Co. for use as refractory material, concrete aggregate, and railroad ballast. Reynolds Metals Co. operated its Jones Mill aluminum-reduction plant at about 50-percent capacity throughout the year.

Howard.—Value of mineral production, consisting of cement, stone, clay, and sand and gravel remained virtually the same. Ideal Cement Co. manufactured cement, utilizing in part clay, chalk, and marl mined from pits adjacent to its plant at Okay.

Independence.—The county led the State in open-market lime production. Batesville White Lime Co. increased production of hy-

drated lime and quicklime and prepared limestone for glass and paper industries and for us as asphalt filler, mineral food, and concrete aggregate. Galloway Sand and Gravel Co. accounted for all sand and gravel production. Batesville Marble Co. and Wolford Marble Co., Inc., quarried marble for building stone. Dimension sandstone was produced by Bristow Stone Co. and Varnell Sandstone Co.

Izard.—The county ranked first in value of sand production and fifth in value of stone production. High-quality silica sand was mined and processed by Silica Products Co., Inc., at Guion. National Silica Co. quarried and processed silica sand at its plant west of Melbourne. Limestone was mined and crushed for manufacture of lime, metallurgical flux, and for soil conditioner by Arkansas Limestone Co. and Aluminum Company of America.

Jackson.—Value of stone and sand and gravel output more than doubled. Mobley Construction Co., Inc., dredged sand from White River. Ben M. Hogan & Co. quarried and crushed sandstone for concrete aggregate.

Jefferson.—Mineral production consisting of lime and sand and gravel was about equal in value to that produced in 1961. Pine Bluff Sand & Gravel Co. and Southeast Construction Co. dredged, washed, and classified sand from Arkansas River for use in building and construction projects. Dierks Paper Co. and International Paper Co. used lime in paper manufacture.

Johnson.—The county ranked first in value of coal output. Other mineral production included natural gas, clay, sand and gravel, and stone. Total value of the commodities was 2 percent less than the 1961 value. Three underground and three strip mines produced a total of 112,239 short tons of coal valued at $809,671. Eureka Brick and Tile Co. produced clay at a slightly increased rate for use in heavy clay products. Southeast Construction Co. supplied sand for construction uses. Crushed sandstone for riprap was quarried by Mississippi Valley Engineering & Construction Co. for the U.S. Army Corps of Engineers. Exploratory drilling resulted in discovery of Batson gasfield in the Kelly sand of the Atoka formation. The discovery added substantially to gas reserves in the county.

Lafayette.—The county ranked fourth in total mineral output, led in production of byproduct elemental sulfur recovered in cleaning sour natural gas, was third in crude petroleum and natural gas production, and second in output of natural gas liquids. McKamie Gas Cleaning Co. and Sunray DX Oil Co. were joined by Austral Oil Co., Inc., in producing natural gasoline and cycle products. The former companies also produced substantial quantities of LP gases and sulfur. A significant tonnage of sand and gravel was produced by Gifford-Hill Co., Inc. Oil-well and gas-well drilling activities resulted in completion of 11 new field wells and additional supplies of oil and gas.

Lawrence.—Value of mineral production, nearly all attributable to stone output, increased more than 2½ times. Ben M. Hogan & Co., Valley Stone Co., Inc., Verkler Limestone Co., and D. F. Jones Construction Co. mined and crushed limestone in the Black Rock area for use in concrete aggregate, as roadstone and riprap, and for agri-

cultural purposes. Black Rock Sand and Gravel Co., Inc., and L. F. Parker supplied sand and gravel for building and road construction projects.

Little River.—Value of mineral output decreased 15 percent. Arkansas Cement Corp. completed a $7.5 million expansion program which doubled its plant capacity to 2.8 million barrels of cement annually. Ark-La Limestone Corp. quarried and ground limestone for agricultural use. Various operations were responsible for sand and gravel production.

Logan.—Aggregate value of mineral output decreased 17 percent. Production of all minerals decreased compared with that of 1961. Natural gas was the county's most important mineral commodity; however, all efforts to complete a new gas discovery were unsuccessful. Logan County Building Stone Co., John Schwartz Quarry, and Rainbow Stone Co. quarried and processed dimension sandstone. Mississippi Valley Engineering & Construction Co. accounted for most of the crushed sandstone output, which was used for bank stabilization programs along Arkansas River by the U.S. Army Corps of Engineers. Hixon Coal Co. operated the largest underground mine in the county.

Miller.—Combined production value of petroleum, natural gas, sand and gravel, and clay decreased 17 percent. Petroleum was the most important mineral commodity. The county was fourth in oil and gas well drilling activities. Outpost drilling was successful in discovery of the new Kelly Bayou oilfield. Post-discovery drilling was largely successful and further development well drilling activities were expected to provide a stimulus for increased oil exploration. The county ranked second in value of sand and gravel output; clay production diminished, and the county dropped from fourth to sixth place in rank.

Montgomery.—Slate was quarried and processed to roofing granules and slate flour by Bird & Son, Inc. Crude barite was shipped from stock by Baroid Division of National Lead Co. Value of the sand and gravel output was about 10 percent less than in 1961. A small quantity of gem stones (quartz crystals) also was produced.

Nevada.—Mineral economy of the county was enhanced by production of brown iron ore in significant quantities. Total value of mineral production, including petroleum, natural gas, and sand and gravel increased 15 percent.

Ouachita.—Mineral output value, comprised of petroleum, sand and gravel, natural gas, and clays, was less than in 1961; however, aggregate value was sufficient to rank the county among the five leading mineral producing counties. Pine Bluff Sand and Gravel Co., Standard Gravel Co., and Reynolds & Williams supplied the major part of the sand and gravel production. Hope Brick Works mined miscellaneous clay for brick and tile manufacture at its Chidester plant. The county ranked fourth in petroleum production. Berry Asphalt Co. operated an oil refinery at Stephens. Thirty-eight successful oil and gas wells were completed during the year.

Pike.—Production of gypsum, gem stones, and sand and gravel was generally less than that recorded in 1961; consequently, value of mineral output was about half that reported in the previous year. Diamonds were found in the Murfreesboro area in about the same

quantity as in 1961. Various producers accounted for a small output of sand and gravel.

Pope.—Combined production value of natural gas, coal, sand and gravel, and stone was 18 percent less than that reported in 1961. A slight increase in value of the natural gas production and sand and gravel output was not sufficient to offset substantial losses in production value of other minerals. Pittsburg and Midway Coal Mining Co. terminated its coal mining operation early in the year. The U.S. Army Corps of Engineers projects required lesser quantities of crushed sandstone and accounted for the major drop in stone output. Texas Ledgestone Co. continued quarry operations and production of dimension sandstone. Wildcat drilling was successful in discovery of Booger Hollow gasfield in the western part of the county.

Pulaski.—Value of mineral output increased 45 percent because of the large increase in production of stone and clay. Big Rock Stone and Material Co., Jeffery Sand Co., and John D. Ott supplied sand and gravel for building, paving, and fill purposes. A substantial part of the sand production was consumed in construction of 18 Titan missile bases north of Little Rock. The U.S. Army Corps of Engineers contracted for large quantities of crushed syenite and sandstone for use in Arkansas River development projects. Big Rock Stone and Materials Co., West Lake Quarry & Material Co., Mid-Continent Stone and Construction Co., Markham & Brown Co., Carter Construction Co., Pine Bluff Sand & Gravel Co., Eugene Luhr & Co., Yancy B. Turner, Mississippi Valley Engineering & Construction Co., and Jeffery Stone Co. supplied most of the crushed stone for these projects. Big Rock Stone & Materials Co. also quarried syenite for roofing granules, railroad ballast, roadstone, concrete aggregate, and fill.

Stauffer Chemical Co. (Consolidated Chemical Industries Division) and A. P. Green Fire Brick Co. mined and processed kaolinitic clay to supply refractory brick and aluminum sulfate. The latter company began construction of new plant facilities southwest of Little Rock much nearer to the clay pits which supply the raw materials. The plant was scheduled to begin operation in January 1963.

Bauxite was mined, shipped, or consumed from stock by American Cyanamid Co., Campbell Bauxite Co., Porocell Corp., Reynolds Mining Corp., and Stauffer Chemical Co. The companies operated drying and activating plants to process bauxite for abrasives, chemicals, and other industrial applications.

Saline.—Total value of bauxite, lime, slate, talc, and sand and gravel production was the second highest of record. The county ranked third in the State in value of mineral production. Increases in bauxite output, the county's leading mineral commodity, and soapstone production largely accounted for a 32 percent gain in aggregate mineral production value. Alpha Minerals Co., Houston, Tex., began exploration drilling for iron during the year; at yearend, results of the drilling program had not been completely evaluated. The project was partially financed by funds from the Office of Minerals Exploration, an agency of the U.S. Department of the Interior.

Reynolds Mining Corp., Aluminum Company of America, and American Cyanamid Co. mined and processed bauxite ores. Lime for

use in processing bauxite to alumina was produced by Reynolds Mining Corp. and Aluminum Company of America.

Milwhite Co., Inc., quarried and processed soapstone and slate for filler in asphalt, insecticides, roofing, and rubber. Sand and gravel was mined, washed, and classified by Holland Gravel Co., Inc., Stanley Industries, and various other producers.

Searcy.—Mineral production value, comprised of stone and sand and gravel, increased 26 percent. McGeorge Contracting Co. and Freshour Corp. supplied the mineral commodities which were consumed in highway construction projects. Peyton Creek Phosphate Mining Co. began exploration and development activities in an area underlain by phosphate rock adjacent to the common boundary of Searcy and Van Buren Counties. At yearend, test shipments of ground phosphate rock had been made to determine the potential value of the material as a fertilizer agent.

Sebastian.—A decrease in coal production resulted in a drop from first to third in rank as a coal-producing county; seven mines with outputs exceeding 1,000 short tons annually were active. Value of natural gas production increased by nearly $100,000. Production of crushed stone added significantly to total value of mineral output. Overall mineral value gained 22 percent. Development and exploration well drilling for natural gas was considered successful because a total of 10 new gas sources were discovered; of particular significance was the discovery of Bonanza and Ursula gasfields. The new pay zones were in deeper horizons of Devonian and Silurian ages and were expected to stimulate drilling of deeper holes in several geologically favorable areas. Production of clay and sand and gravel also aided the mineral economy of the county.

Union.—The county ranked second in total value of mineral production in the State. A drop in output of petroleum and natural gas liquids accounted for the overall decrease of 9 percent in value. Increases were notable in production of bromine and clay. Petroleum was the most important mineral commodity and accounted for 86 percent of aggregate value of mineral output. Monsanto Chemical Co., Denton Corp., and Querles Oil Co. operated natural gasoline plants. The county led in oil and gas well drilling activities; 46 of 98 holes were successful in locating new sources of supply. Discovery of Mill Creek oilfield was of particular significance.

Michigan Chemical Corp. and Arkansas Chemicals, Inc., recovered bromine from oil well brines at plants near El Dorado. El Dorado Brick Works produced miscellaneous clay for brick manufacture.

Washington.—Value of mineral output consisting of stone and natural gas increased 13 percent. McClinton Bros. mined and crushed limestone for concrete aggregate, roadstone, and soil conditioner. Natural gas production increased about 60 percent.

White.—Acme Materials Co. and Freshour Corp. quarried and crushed a substantial quantity of sandstone for riprap, concrete aggregate, roadstone, and railroad ballast.

The Mineral Industry of California

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the California Department of Natural Resources, Division of Mines and Geology for the collection of mineral data.

By L. E. Davis,[1] C. D. Edgerton,[2] Roy Y. Ashizawa,[2] and L. Giorgetti[3]

MINERAL production for California was valued at $1,467,295,000 in 1962, nearly $32 million more than in 1961. The increase resulted primarily from a higher average unit price for a lower crude petroleum output, and a 4-percent increase in marketed production of natural gas. Nonmetallic mineral production value rose 4 percent, due chiefly to increased shipments of cement. Metals output declined 2 percent in value despite reported increases for all but three: copper, iron ore, and mercury.

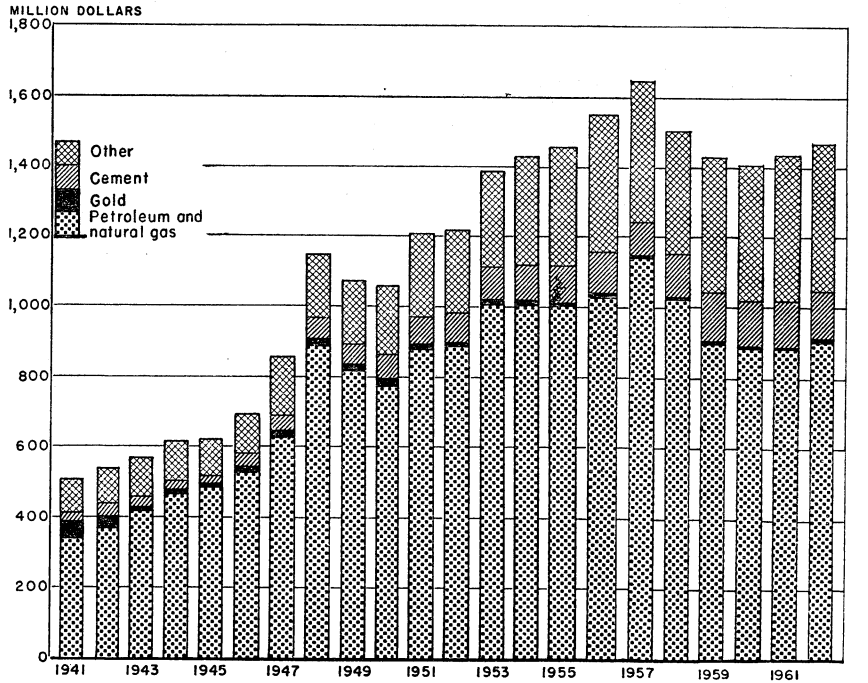

FIGURE 1.—Value of petroleum and natural gas, gold, cement, and total value of mineral production in California, 1941–62.

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[2] Mineral specialist, Bureau of Mines, San Francisco, Calif.
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TABLE 1.—Mineral production in California[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite—short tons	21,203	$295	6,945	$133
Boron minerals—do	602,613	46,936	646,613	49,336
Cement[2]—376-pound barrels	41,090,000	129,836	43,667,000	139,151
Clays—short tons	3,041,000	6,405	3,137,000	7,349
Copper (recoverable content of ores, etc.)—do	1,382	829	1,162	716
Gem stones	(3)	200	(3)	200
Gold (recoverable content of ores, etc.) troy ounces	97,644	3,418	106,272	3,720
Gypsum—short tons	1,574,000	[4] 3,733	1,747,000	4,113
Lead (recoverable content of ores, etc.)—do	103	21	455	84
Lime—do	[4] 503,000	[4] 9,062	470,000	8,454
Magnesium compounds from sea water and bitterns (partly estimated) (MgO equivalent)—do	90,534	6,467	76,445	6,077
Mercury—76-pound flasks	18,688	3,693	15,951	3,050
Mica, scrap—short tons	950	12	(5)	(5)
Natural gas—million cubic feet	556,241	157,416	564,220	163,624
Natural gas liquids:				
Natural gasoline and cycle products thousand gallons	762,878	57,645	716,904	54,460
LP gases—do	424,767	21,805	407,378	19,294
Peat—short tons	46,348	501	33,900	331
Petroleum (crude)—thousand 42-gallon barrels	299,609	728,050	[6] 296,572	[6] 741,430
Pumice—short tons	610,000	2,202	573,000	2,615
Salt—do	1,601,000	(5)	1,643,000	(5)
Sand and gravel—do	110,181,000	124,111	107,660,000	124,922
Silver (recoverable content of ores, etc.) troy ounces	93,000	86	133,000	144
Stone[7]—short tons	33,850,000	50,327	34,776,000	54,722
Talc, soapstone, and pyrophyllite—do	161,068	1,524	117,912	1,339
Wollastonite—do	4,075	42	(5)	(5)
Zinc (recoverable content of ores, etc.)—do	304	70	322	74
Value of items that cannot be disclosed: Asbestos, bromine, calcium chloride, carbon dioxide, masonry cement, coal (lignite), diatomite, feldspar, fluorspar, (1961), iodine, iron ore, lithium minerals, magnesite, (1961), manganiferous ores, (1962), molybdenum, perlite, platinum-group metals, potassium salts, pyrites, rare-earth metals concentrates, sodium carbonate, sodium sulfate, sulfur ore, tungsten concentrate, and values indicated by footnote 5	----------	81,051	----------	81,957
Total	----------	[4] 1,435,737	----------	1,467,295

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes masonry cement included with "Value of items that cannot be disclosed."
[3] Weight not recorded.
[4] Revised figure.
[5] Figure withheld to avoid disclosing individual company confidential data.
[6] Preliminary figure.
[7] Includes slate.

Employment and Injuries.—Overall employment in the mineral industries (excluding officeworkers and the mineral fuels industries) declined about 17 percent, according to preliminary data compiled by the Federal Bureau of Mines. Only the nonmetallic mine and mill group reported an employment increase, however slight, which was credited to natural salines operations. Total lost-time injuries dropped but fatalities rose. Fatal injuries at metal and nonmetallic mines and mills were unchanged from 1961 at two each; those at stone quarries rose from one to five, and those at sand and gravel operations increased from five to eight. The injury-frequency rate (number of disabling injuries per million man-hours) was 18.69 compared with 19.67 in 1961.

California participants in the Bureau of Mines 1962 National Safety Competition who reported no lost-time injuries during 1962 included 1 open-pit diatomite deposit, 2 underground limestone quarries, 2 gypsum mines, 2 lime plants, 12 stone quarries, and 23 sand and gravel operations. The Pacific Cement and Aggregates, Inc., Eliot No. 104 plant won highest honors in the pit group of the National Sand and Gravel Safety Competition. The award was made in recognition of an outstanding safety accomplishment in working 169,156 man-hours during the competitive year 1962 without a disabling work injury.

TABLE 2.—Employment and injuries in the mineral industries [1]

Industry	1961 [2] Employees	Manhours (thousands)	Injuries: Fatal	Injuries: Nonfatal	Injuries: Total	Injury-frequency rate [4]
Metal mines and mills [5]	2,386	4,251	2	120	122	28.70
Nonmetallic mines and mills	4,510	9,862	2	221	223	22.61
Stone quarries	4,983	11,017	1	183	184	16.70
Sand and gravel operations	6,759	12,588	5	208	213	16.92
Total	18,638	37,718	10	732	742	19.67
	1962 [3] Employees	Manhours (thousands)	Injuries: Fatal	Injuries: Nonfatal	Injuries: Total	Injury-frequency rate [4]
Metal mines and mills [5]	1,974	3,686	2	92	94	25.50
Nonmetallic mines and mills	4,539	9,386	2	186	188	20.03
Stone quarries	4,402	10,411	5	130	135	12.97
Sand and gravel operations	4,644	8,614	8	175	183	21.24
Total	15,559	32,097	17	583	600	18.69

[1] Excludes the mineral fuels industry and officeworkers.
[2] Final figures.
[3] Preliminary figures.
[4] Total number of disabling injuries during the year per million man-hours.
[5] Includes metallurgical plants to avoid disclosing individual company confidential data.

Consumption, Trade, and Markets.—California led all other States in diversity of mineral production and in the value of raw materials consumed. Only in those instances where California was the sole or principal domestic supplier did production exceed consumption. The State was dependent on outside sources, foreign and domestic, for many mineral requirements, particularly mineral fuels. Refinery receipts of crude oil, from all sources, were 13 percent more than 1961, and natural gas receipts—from New Mexico, Texas, and Canada—rose nearly 12 percent. However, plants within the State processed 3 percent less wet gas than in 1961, and output of natural gas liquids was down 5 percent. California ranked third in petroleum production, yet consumed more petroleum products than any other State; it was sixth in natural gas production, but surpassed all but one State in consumption of this fuel. Over 9.5 million motor vehicles were registered in California in 1962, and there were 20,680 operating retail service sta-

tions at yearend. More than 16 percent of the State total tax revenues was derived from fuels used in motor vehicles and motor transportation.

California produced almost twice as many mineral commodities as the second-ranking State. This diversity of production required a wide variety of marketing practices. The State was the sole United States source for boron minerals and compounds and the leading producer of gypsum, iodine, mercury, rare-earth concentrates, sand and gravel, sodium sulfate, and sulfur ore. Sand and gravel tonnage was more than double that of the next leading State. Gypsum producers supplied a larger output than any other State, yet a large tonnage of this mineral was imported from Mexico. Many nonmetal ores from deposits outside the State—principally in Nevada and Arizona—were processed in California plants to supply local demand. A few processors were also producers; others milled the minerals for customers or purchased them for resale. Plants for processing some metal ores and concentrates, such as those of copper, manganese, molybdenum, and rare-earths, were in other States. Notable exceptions were The American Smelting & Refining Co. primary lead smelter and zinc fuming plant at Selby, Contra Costa County; the Kaiser Steel Corp. integrated steel plant at Fontana, San Bernardino County; and the Union Carbide Nuclear Co. tungsten processing and chemical plant at Pine Creek, Inyo County.

TABLE 3.—Principal custom mills, commercial grinding plants, and primary smelters in 1962

Company	County	Nearest city or town	Minerals processed	Remarks
C. K. Williams (Anchor Minerals Division).	Alameda	Emeryville	Nonmetals	Commercial grinding.
American Smelting and Refining Co.	Contra Costa	Selby	Lead, zinc, silver, gold.	Smelter, refinery, and fuming plant.
Fresno Agricultural Chemical Co.	Fresno	Fresno	Nonmetals	Custom mill.
Huntley Industrial Minerals Co.[1]	Inyo	Bishop	do	Do.
Union Carbide Nuclear Co.	do	do	Tungsten ore and concentrates.	1,000 ton-a-day flotation chemical plant.
Butte Lode Mining Co.	Kern	Randsburg	Gold and silver.	Stamp mill, amalgamation and gravity concentrator.
American Minerals Co.	Los Angeles	Los Angeles	Nonmetals	Commercial grinding.
Western Talc Co.	do	do	do	Contract grinding.
Industrial Minerals & Chemical Co.	Sacramento	Florin	do	Do.
New Idria Mining & Chemical Co.	San Benito	Idria	Mercury	Custom mill.
Kaiser Steel Corp.	San Bernardino.	Fontana	Iron ore	Blast furnaces, steel plants, and fabricating plants.
C. K. Williams (Anchor Minerals Division).	do	Victorville	Nonmetals	Commercial grinding.
Wildberg Bros. Smelting & Refining Co.	San Francisco.	San Francisco.	Gold, silver, and platinum.	Smelting, refining, and manufacturing.

[1] Formerly operated by Callahan Mining Corp.

TABLE 4.—Sand and gravel, crushed stone, and portland cement sold or used in 1962, by methods of transportation

(Thousand short tons)

Material	Railroad	Motortruck	Waterway	Not stated [1]	Total
Sand and gravel (commercial)	4,003	84,569	[2]	[2]	88,572
Crushed stone (commercial)	3,210	23,465	1,904		28,579
Portland cement	1,515	6,686	[2]	8	8,209

[1] Includes interplant transfers to batching units, etc.
[2] Included with "Motortruck" to avoid disclosing individual company confidential data.

Trends and Developments.—A number of important developments occurred in 1962 that were of special significance in the mineral industries. Construction was underway at yearend on a 30-well drilling platform by Signal Oil & Gas Co. about 1½ miles offshore at Huntington Beach. The company suspended operations at its Long Beach refinery, and announced plans for construction of an Isomax hydrocracking unit at its Bakersfield refinery. Tidewater Oil Co. was nearing completion of a $20 million isocracker complex at Avon, Contra Costa County; included was an electrical precipitator to remove unburned particles from coker flue gas and a unit for the removal of mercaptan odors from sour gasoline. Standard Oil Co. of California started work on a new 10,000-barrel-per-day hydroformer, placed a major refining unit under complete computer control at its El Segundo refinery, and installed a Udex aromatic hydrocarbon extraction unit at its Richmond refinery. Also, Standard announced it had partially converted its 180-well Poso Creek field, Kern County, to automatic control and had equipped offshore drilling platforms with automatic gaging and reporting devices. Richfield Oil Corp. began waterflood operations on a pilot basis in the Coal Oil Canyon pool, Santa Barbara County. Tidewater Oil Co. was modernizing its 263-mile San Joaquin Valley pipeline that transports low-gravity crude to Avon and stepped up efforts to recover oil and gas from older properties in the Ventura area and the Los Angeles basin by perforating in more productive sands. Twenty-five such wells were perforated for production from previously cased-off reserves. The oil production of Union Oil Co. of California was stimulated by 44 waterflood projects in 20 oilfields. Production from the La Cienagas (residential Los Angeles) field alone increased from 1,700 to 6,100 barrels daily in 1962.

Standard drilled more than 1,000 successful wells in 1962, chiefly in the San Joaquin Valley and the Los Angeles basin. Exploratory drilling by the company resulted in two gasfield discoveries on a jointly owned State offshore lease near Santa Barbara, a new pool discovery in the San Joaquin Valley, a new gasfield in the San Francisco Bay area, and participation in three other gas discoveries and one important oil discovery. Union completed an exploratory gas well in December near Sacramento that tested 12 million cubic feet daily. Shell Oil Co. had an important gas discovery at Brentwood in the Sacramento basin, and acquired a half interest in two 4,250-acre tracts offshore from Santa Barbara County. Tidewater completed a promising exploratory gas well in the Wild Goose field, Butte County, that had additional pay zones yet to be tested at yearend.

Union Carbide Nuclear Co. developed an unusual asbestos deposit in Fresno County and decided to build a pilot plant to produce asbestos fiber. Jefferson Lake Asbestos Corp. placed its Copperopolis, Calaveras County, asbestos operations on a 3-shift, 5-day basis October 1 and reached design capacity of 2,500 tons of ore a day by yearend. Construction underway at the Lucerne Valley operations of Permanente Cement Co. was expected to boost cement production capacity to 18.9 million barrels annually by early 1963. U.S. Borax & Chemical Corp. began constructing terminal facilities at its Wilmington plant for bulk loading borate products into oceangoing vessels and announced additions to its processing facilities at Boron, Kern County. At Ione, Amador County, a new glass sand plant of International Pipe & Ceramics Corp. was placed on stream in December. The company reported it had received the first order for blast-furnace refractories ever produced on the west coast. Construction was delayed temporarily on the Mojave titanium dioxide plant of American Potash & Chemical Corp., but officials expected initial production of pigment would be available for market in 1964. The company was installing a new larger evaporation unit at Trona and placed on stream a new boric acid plant. Modernization and expansion was begun at the South San Francisco plant of Merck & Co., Inc., for extraction of high-purity magnesium salts from seawater. The Flintkote Co. announced that land purchases and lease arrangements made on properties in Calaveras and Los Angeles Counties would insure long-range availability of sand and gravel and limestone supplies. The Camanche sand plant of Pacific Clay Products was condemned, as part of a water conservation and flood control project, and purchased by East Bay Municipal Utility District. The first phase of a thorough modernization at the Crestmore plant of Riverside Cement Co. was completed in the summer of 1962 and completion of the last phase was expected by fall of 1963. A plant for producing new types of experimental high-purity basic refractory materials was completed at the Moss Landing magnesia plant of Kaiser Aluminum & Chemical Corp. Leslie Salt Co. harvested its first salt crop at its Napa County facility early in 1962.

Union Carbide began a new tunnel at its Pine Creek tungsten mine, Inyo County. Another chapter in California mining history ended on December 31, when Mountain Copper Co. closed its pyrite mine in Shasta County. The company had mined continuously in the Iron Mountain area since 1896. The availability of byproduct sulfur from domestic and Canadian natural gas at a lower price was given as the reason for the shutdown. On February 1, Kennedy Minerals Co. was acquired by C. K. Williams Co., Anchor Minerals Division. Anchor closed Kennedy's Los Angeles mill and transferred all products and grinding facilities to Anchor's Victorville mill, San Bernardino County. In October, C. K. Williams Co. became a subsidiary of Chas. Pfizer & Co., Inc.

On October 2, Kaiser Steel Corp. announced it had eliminated the historic differential in steel prices between the west coast and the rest of the Nation. This action was followed by other western steel companies. Kaiser made a major improvement in raw-materials handling operations at its Eagle Mountain facilities, Riverside County,

and in October, began shipping iron ore to Japan under a 10-million-long-ton contract that had been negotiated in 1961.

TABLE 5.—Office of Minerals Exploration contracts in force during 1962

County and contractor	Commodity	Contract [1]	
		Date	Total amount
Inyo: William R. Noack	Copper	June 14, 1962 [2]	$60,910
Napa: Guisti & Baker	Mercury	June 30, 1961	[3] 17,640
Plumas: California Alluvial Mining Corp	Gold-platinum	July 15, 1962	25,650
San Luis Obispo: Selby & Dawson	Mercury	Dec. 31, 1962	52,730
Shasta: Shasta Minerals & Chemical Co	Copper-zinc	June 10, 1960 [2]	[3] 89,620
Sierra: Gold Queen Mining Co	Gold	Oct. 1, 1962	39,450
Sierra: S. E. & K. M. Brainerd	do	Aug. 7, 1962	16,200
Yolo: Universal Silvers, Inc. [4]	Mercury	June 16, 1958	78,770

[1] Government participation, 50 percent in all contracts.
[2] Effective date of amendment.
[3] Terminated in 1st quarter of 1962.
[4] An original DMEA contract.

Legislation and Government Programs.—Plans were formulated by the City of Long Beach for development of the seaward portion of the Wilmington oilfield. Geologists of the Long Beach Harbor Department and others estimated that petroleum reserves in this portion of the field were 1.5 billion barrels. Ownership of the involved land is vested jointly in the City and State, with Long Beach acting as trustee in the administration of the land. Controversy arose over portions of the plans, and at yearend hearings were slated before the State Lands Commission for approval of the field development plans. A series of hearings were held resulting in a request by the California Public Utilities Commission for legislation empowering the agency to regulate the price of gas at the wellhead.

In March the Secretary of the Interior amended the authority delegated to the Director, Bureau of Land Management (BLM), to take action on mineral leases of submerged lands of the Outer Continental Shelf, so as to provide prior approval by a Secretarial officer before issuance of calls for bids on oil and gas or other mineral lease offerings and the publication of notices of the offer of lands for lease. In September the Department of the Interior requested competitive bids for the sale of oil and gas leases for about 800,000 acres of the California coast north of Point Conception, the first offer to sell oil and gas leases on submerged land off the California coast. The tracts offered were Eureka, 241,000 acres; Point Arena, 130,000 acres; San Francisco, 251,000 acres; and Morro Bay, 171,000 acres. In December the Department of the Interior opened a new office in Los Angeles, under BLM, to handle Federal offshore oil and gas leasing operations on the west coast.

Public Land Orders restored about 68,000 acres of land to mineral location under U.S. mining laws, 70 percent of which was restored by National Park Service, Bureau of Reclamation, and BLM, agencies of the Department of the Interior. Land orders also withdrew over 440,000 acres for use by Federal agencies, more than 200,000 acres of which was for the Department of Defense (Army, Navy, and Air Force) and about 150,000 acres for the Department of Agriculture

(chiefly the U.S. Forest Service). In 1962, California received $2,598,917.34 from the U.S. Government in bonuses, royalties, and rentals from mineral leasing on Federal lands within the State borders.

Seven contracts for minerals exploration under the supervision of the Office of Minerals Exploration (OME) were in force all or part of 1962. An original Defense Minerals Exploration Administration (DMEA) contract was terminated. Four new OME contracts were executed in 1962 and two were terminated. At yearend five contracts were in force—two for gold, and one each for copper, gold-platinum, and mercury. Seventeen additional applications were received in 1962: nine for gold, four for gold-silver, and two each for silver-lead-zinc and mercury.

Participation in the Lead and Zinc Mining Stabilization Program for the calendar year 1962 was well below expectations. The program, authorized by Public Law 87–347 and enacted October 3, 1961, did not have funds appropriated or regulations published until July 1962. Between September 1 and yearend, three California producers were certified, two of which received 1962 eligibility quotas; the third was certified too late to participate before 1963. The Defense mine, Inyo County, was certified for lead only; the Copper Bluff mine, Humboldt County, for zinc only; and the Santa Rosa mine, Inyo County, for both lead and zinc (excepting 1962).

Resources work in California by the Bureau of Mines included continued investigation of reported beryllium occurrences, the mercury potential of California (as a part of the total domestic potential), a survey of mineral fillers, and clay resources investigations. As part of a long-range program to encourage increased use of industrial minerals, under the terms of a cooperative agreement in effect since 1959, the Bureau of Mines and the California Division of Mines and Geology continued joint exploration ventures in an effort to discover new reserves of minerals currently in short supply in California. Deposits of clays, industrial sands, and heavy minerals were drilled at Cherokee, Butte County, and a sanbornite (barium silicate) prospect was drilled in Fresno County.

At the Bureau of Mines San Francisco Petroleum Research Laboratory, research was directed toward obtaining maximum recovery of petroleum through refinement of existing techniques, and to the development of more efficient methods of extraction. This research opened a broad new field for predicting the performance of petroleum reservoirs with complicated well-spacing patterns in which gas, oil, and water are flowing. In the Bureau's Berkeley Thermodynamics Laboratory, of the Reno (Nev.) Metallurgy Research Center, thermodynamic studies of clay minerals were conducted, and high-temperature heat content measurements of rare-earth sesquioxides were in progress.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Carbon Black.—Three companies produced carbon black. More than 55 million pounds valued at nearly $3 million was manufactured, most of which was consumed by the rubber and metals industries.

Continental Carbon Co. produced both high-abrasion furnace (HAF) and fast-extrusion furnace (FEF) blacks at its Bakersfield refinery, Kern County. At Mojave, Kern County, United Carbon Co. produced HAF, FEF, general-purpose furnace (GPF), semi-reinforcing furnace (SRF), and intermediate-abrasion furnace (ISAF) blacks. Shell Chemical Corp. produced thermal black as a byproduct in its ammonia fertilizer plant at Pittsburg, Contra Costa County.

Carbon Dioxide.—Tidewater Oil Co. produced the State's only marketed carbon dioxide, in a natural gasoline plant near Taft, Kern County. Output was about double that in 1961. Most of the product was used by aircraft companies for freezing rivets, or by beverage companies in making carbonated water. In July, Standard Oil Co. of California placed a carbon dioxide extraction plant on stream near Taft, Kern County. The plant was built to process natural gas to pipeline specifications.

Coal (Lignite).—American Lignite Products Co., Inc., was again the sole commercial producer of lignite. The mineral, from the company mine near Ione, Amador County, was processed to recover montan wax. The extracted wax was sold in three forms: unrefined, semi-refined, and fully refined. Most of these products were consumed by the paper, polish, and rubber industries.

Coke.—The Fontana plant of Kaiser Steel Corp. had the only coking facilities in California. Most of the plant product was consumed in blast furnaces by the producer. Coking coal was shipped to the plant from Kaiser coal mines in northern New Mexico and east central Utah. Production declined from 1961 because of lower pig iron output.

Petroleum coke production reached an alltime high of 1,524,000 tons, an increase of about 9 percent over 1961. A slight increase was reported in output of noncommercial catalyst coke.

Four producers operated a total of five cokeries: Socony Mobil Oil Co., Inc., at Torrance, Los Angeles County; Tidewater Oil Co. at Avon and Union Oil Co. of California at Oleum, Contra Costa County; Union at Arroyo Grande, San Luis Obispo County; and Signal Oil and Gas Co. at Bakersfield, Kern County. Tidewater and Signal used the fluid coking process (about 1,380 tons daily capacity) and Socony Mobile and Union employed the delayed coking process (about 4,180 tons daily capacity).

Natural Gas.—Net withdrawals of natural gas were virtually the same as in 1961. A decline in production from oil zones was offset by a gain in output from dry-gas zones. Fifty-nine percent of the total was oil-zone production although there was a significant increase in dry-gas output. The most notable increases were from dry-gas zones in Sutter, San Joaquin, Santa Barbara, and Colusa Counties; decreases were reported for wet gas from oil zones in Kern, Kings, and Ventura Counties. The volume of wet gas vented (blown to air) was less than 1 percent of the total withdrawn.

Exploration and development drilling for dry gas centered around the Sacramento Valley and northern San Joaquin Valley. The latter's Lathrop field, discovered in late 1961 and considered the State's second largest dry gasfield, was developed on an intensive scale. Considerable development also took place in the Sutter Buttes and Grimes fields, both in the central Sacramento Valley. Although California had

1,252 potentially productive dry-gas wells in 1962, the largest number in production was 912. Dry-gas discoveries totaled 17, resulting from 417 wells drilled, half of which were principally gas explorations. Of the 17, 10 were new fields and 7 were new pool discoveries. Major interest was directed to two new fields: Brentwood, Contra Costa County, and Lindsay Slough, Solano County. Both fields gave indications of holding large reserves. The volume of natural gas injected for repressure and pressure maintenance was about 2 percent less than in 1961. At yearend, nearly 97 billion cubic feet of gas was in underground storage.

Natural gas shipments into California totaled 985,665 million cubic feet, an average of 2,700 million cubic feet per day. The shipments came from Texas, Oklahoma, New Mexico, Arizona, Utah, and Canada.

TABLE 6.—Natural gas, natural gas liquids, and petroleum produced in 1962, by counties

County	Natural gas [1] (million cubic feet)		Natural gas liquids		Petroleum [1] (thousand barrels)
	Oil zones	Dry gas zones	Natural gasoline and cycle products (thousand gallons)	LP gases (thousand gallons)	
Butte		9,306			
Colusa		13,688			
Contra Costa		3,664			
Fresno	28,017	253	(2)	(2)	26,730
Glenn		18,186			
Humboldt		1,433			
Kern	107,146	8,282	190,292	149,730	90,595
Kings	9,645	1,322	(2)	(2)	1,388
Los Angeles	80,319	2,255	205,752	63,473	74,386
Madera		2,040			
Monterey	5,647				11,230
Orange	32,948		85,388	19,317	31,320
Riverside					3
Sacramento		50,638			
San Benito	259	1,397			237
San Bernardino	129				87
San Joaquin		22,300			
San Luis Obispo	792		(2)	(2)	1,260
San Mateo	12				97
Santa Barbara	22,788	10,672	51,686	45,188	25,487
Solano		37,234			1
Sonoma		157			
Sutter		20,252			
Tehama		1,920			
Tulare		5,358			46
Ventura	75,618	767	133,584	75,423	33,705
Yolo		2,030			
Undistributed			50,202	54,247	
Total	[3] 355,459	[3] 208,761	716,904	407,378	296,572
Value (thousands)	[4] $103,083	[4] $60,541	$54,460	$19,294	[4] $741,430

[1] Quantity figures for natural gas and petroleum by courtesy of California Department of Natural Resources, Division of Oil and Gas.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Less natural gas vented and wasted.
[4] Preliminary figure.

Natural Gas Liquids.—The volume of natural (wet) gas processed declined to 539,594 million cubic feet, 2 percent less than in 1961. Of the 69 operating plants at the beginning of 1962, 4 were shut down and 1 new plant was completed but was combined with an existing plant,

leaving a total of 65 at yearend. All 65 plants were within 8 contiguous counties. More than half the total output of natural gasoline and cycle products, and liquified petroleum (LP) gas came from plants in Kern and Los Angeles Counties.

Production of natural gasoline and cycle products and LP gas declined 6 and 4 percent, respectively, from 1961 figures. The unit value of natural gasoline and cycle products was virtually the same as in 1961 but that of LP gas was significantly lower.

Peat.—Peat production declined to less than 34,000 tons, down 27 percent from 1961. Five deposits in four counties were active most of the year. Of the total production, 80 percent was reed-sedge peat from Contra Costa and Riverside Counties, 16 percent was moss peat from Modoc County, and 4 percent was peat humus from Orange County.

General soil improvement uses consumed 83 percent of the output, 13 percent was utilized in the maintenance of golf course greens, and 4 percent was marketed for a wide variety of uses, principally in mixed fertilizers and as an ingredient in potting and packaging of plants at nurseries. More than 50 percent of all the peat sold was packaged. Only 1,550 tons was prepared and none was prepared beyond the shredded stage.

Petroleum.—California oilfields yielded 1 percent less crude petroleum than in 1961. Seven counties, Fresno, Kern, Kings, Monterey, Orange, San Luis Obispo, and Ventura, had outputs of more than 1 million barrels each, yet recorded significant declines. Major production increases were reported from fields in Los Angeles and Santa Barbara Counties.

Operators filed 2,572 notices to drill and 2,222 new wells were completed to production, a 29-percent increase over 1961. The increase resulted from intensified drilling during the second and fourth quarters. Again, most of the drilling activity centered around the low-gravity fields of the San Joaquin Valley. The drilling of 417 exploratory wells resulted in 28 new oil discoveries. Only about half the wells were drilled as exploration for oil, the others were primarily exploration for gas. Five of the discoveries were new fields and 23 were new zones. The ratio of oil discoveries to exploratory wells drilled was about 1:15, slightly greater than in 1961. The footage drilled was 10,012,404 feet, 20 percent above the 1961 figure. About 25 percent, or 2,471,941 feet was in exploratory wells. The latter figure was almost equally divided between oil and gas exploratory wells.

The number of secondary recovery projects increased and at yearend there were 133 active water-injection projects representing an increase of 14 over 1961. The average Statewide daily water-injection rate reached an alltime high of 1,059,000 barrels per day. The largest of these projects was in operation at the Wilmington field of the Los Angeles basin, which received water at the rate of 500,000 barrels per day. Active gas-injection projects were virtually unchanged in number from 1961, but the volume of gas injected rose 2.7 percent to 617,000 thousand cubic feet per day. Nearly 85 percent of the gas was injected into San Joaquin Valley fields. Twelve liquefied petroleum gas-injection projects also were active. Various thermal processes, all of which were based on raising reservoir temperatures and lowering the viscosity

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of the crudes, were employed to increase production of low-gravity crude oils. Steam and hot water injection and down-hole heaters were used, usually with some success. Six in situ combustion projects were also in operation. In a few isolated instances, diluents were employed to reduce the viscosity of crude oils.

Major refinery modifications were confined principally to the construction of hydrocracking units. Nearing completion at yearend was a 20,000-barrel-per-day Isomax unit at the Avon, Contra Costa County, refinery of Tidewater Oil Co. Signal Gas and Oil Co. was constructing a 5,500-barrel-per-day Isomax unit at its Bakersfield refinery, Kern County. In 1962, 37 refineries were in operation with a total crude oil capacity of 1,535,052 barrels per day, down about 8 percent from 1961.

California again was deficient in crude oil; imports reached nearly 106 million barrels and receipts from out-of-State sources were about 23 million barrels.

NONMETALS

Asbestos.—Coalinga Asbestos, Inc., Fresno County, and Jefferson Lake Asbestos Co., Calaveras County, both completed construction of asbestos milling plants and produced commercial quantities of short-fiber chrysotile asbestos for the first time. Atlas Minerals Corp., Fresno County, also completed construction of an asbestos milling plant and began plant operations in December 1962. Todd Industries, Inc., Coalinga, Fresno County, shipped a small tonnage and discontinued operations early in the year. Asbestos Bonding Co. shipped asbestos fiber from its Phoenix mine, Napa County. Rawhide Asbestos Co., Tuolumne County, was inactive.

All of the California asbestos produced was short-fiber chrysotile. Virtually all was used either as an additive in the manufacture of cement products for the construction industry, or in the manufacture of asphalt floor tile. Several carloads of fiber were shipped to consumers in southern and eastern States.

Union Carbide Nuclear Corp. continued exploration and testing of samples from its holdings in Fresno County. Asbestos Corp. conducted exploration and shipped samples for testing from its Lillis Ranch claims on the Big Blue formation. Several other companies were actively exploring for commercial asbestos deposits, particularly in Siskiyou County and the north coastal counties.

Barite.—Mine output of crude barite dropped appreciably, and shipments to grinders were only one-third those of 1961. Although primary barite shipped from sources outside the State was partially responsible for the decline, the use of lesser tonnages in compounding well-drilling muds was a major factor. Shipments of ground barite reflected the trend with a 20-percent drop for drilling mud use.

Organic Mineral Sales, Ltd., mined crude barite at the Hyduke property (a new producer), Imperial County, and shipped the mineral to its Campo mill but did no grinding in 1962. There were two other new producers during the year, W. T. Sligar near Canyondam, Plumas County, and W. S. White near Denny, Trinity County.

Boron Minerals and Compounds.—All domestic production, and much of the world supply, of boron minerals and compounds came from bedded deposits in Kern and Inyo Counties, or was extracted from

the brines of Searles Lake, San Bernardino County. Boron compounds were refined in plants adjacent to the lake by American Potash & Chemical Corp. and West End Chemical Co. and in Kern and Los Angeles County refineries by United States Borax & Chemical Corp. Stauffer Chemical Co. produced high-purity boron compounds in its San Francisco chemical plant using purchased Kern County crude borates. Kern County Land Co. mined colemanite near Ryan, Inyo County, and filed patent applications for additional claims. In Fresno, U.S. Borax produced a borate chemical used in spraying forest and brush fires. Only a comparatively small tonnage of this chemical was used in 1962 because of competition from other fire-retardant chemicals.

Bromine and Bromine Compounds.—Elemental bromine production, from the Trona plant of American Potash & Chemical Corp., San Bernardino County, was up slightly from that of 1961. Most of the plant output was consumed in compounding bromine products for the chemical and pharmaceutical industries. Inorganic Chemicals Division, FMC Corp., recovered liquid bromine in the treatment of saltworks bitterns at its Newark plant, Alameda County. The company converted the bromine to ethylene dibromide which was sold for use as a soil and seed fumigant. The compound also was used in compounding antiknock fluid for gasoline, most of which was produced outside the State. As in 1961, bromine capacity was in excess of needs due to reduced demand for ethylene dibromide.

Calcium Chloride.—Recovery of calcium chloride from brines collected at Bristol Lake, San Bernardino County, by California Salt Co. and National Chloride Company of America was greater than in 1961. Hill Bros. Chemical Co. purchased crude liquid and produced flake calcium chloride at a plant in the area. Output of flake calcium chloride was higher than in 1961. Both production and average unit value for liquid calcium chloride increased slightly. Products from all three plants were marketed in Arizona, Nevada, and southern California, mainly for use in fireproofing materials and as hygroscopic agents.

Cement.—Production and shipments of portland cement rose to a new high in 1962, surpassing the previous record established in 1959. The gains occurred despite losses in shipments of over 1 million barrels each to Hawaii and Arizona markets and to a 2-month curtailment in construction activity in northern California. Direct shipments of cement to suppliers of ready-mixed concrete increased from 27.1 million barrels in 1961 to 29.5 million. Annual cement capacity was increased by over 1.5 million barrels in 1962, with the entry of a new plant at Redding and improved operating methods at a plant in Redwood City. Output of the State's 13 operating cement plants represented 82 percent of rated capacity.

Nearly 58 percent of the total shipments from California mills were made to the State's southern market, which required 2 million barrels more than in 1961. Northern California demand for California-produced cement increased by only 134,000 barrels, but was directly affected by a 2-month labor stoppage. Shipments to Nevada gained 615,000 barrels. Six northern California cement plants, in Calaveras, San Benito, San Mateo, Santa Clara, Santa Cruz, and Shasta Counties, shipped 14.5 million barrels in bulk, and 2.8 million

in bags. Truck shipments reached 15.9 million barrels; the remainder was by railroad and boat. Southern California's seven plants, in Kern, Riverside, and San Bernardino Counties, shipped 22 million barrels in bulk, and 4.3 million in paper bags. Nearly 19.2 million barrels was transported by truck and 7.1 million by rail.

Calaveras Cement Co., a division of The Flintkote Co., began full-scale production at its new $15 million cement plant near Redding. Major equipment included a 13½- by 425 foot kiln, and three 13- by 17-foot ball mills. Permanente Cement Co. was doubling the annual capacity of its Cushenbury plant to 5.4 million barrels, to be completed by April 1963. Extensive remodeling and expansion also were underway at the Crestmore plant of Riverside Cement Co., Division of American Cement Corp., and at the Colton plant of California Portland Cement Co.

TABLE 7.—Finished portland cement

(Thousand barrels and thousand dollars)

District [1]	Active plants	Capacity Dec. 31	Production	Shipments from mills			Stocks at mills Dec. 31	Estimated consumption
				Quantity	Value			
					Total	Average per barrel		
1961:								
Northern California	5	19,360	16,911	16,944	$54,698	$3.23	1,224	14,401
Southern California	8	32,520	24,254	24,146	75,138	3.11	1,516	23,409
Total	13	51,880	41,165	41,090	129,836	3.16	2,740	[2] 37,810
1962:								
Northern California	6	20,900	17,340	17,345	57,297	3.30	1,218	14,520
Southern California	7	32,520	26,489	26,322	81,854	3.11	1,683	25,347
Total	13	53,420	43,829	43,667	139,151	3.19	2,901	39,867

[1] Northern and Southern California are divided by the northern boundaries of San Luis Obispo and Kern Counties and the western boundaries of Inyo and Mono Counties.
[2] Revised figure.

Clays.—About 2,914,000 short tons of clay was mined for captive use, an increase of 5 percent, while the tonnage produced for open-market sales totaled 223,000 tons, a decline of 17 percent. During the year the production of miscellaneous clay (from mines in 28 counties), used mostly for manufacturing heavy clay products and portland cement, accounted for 84 percent of the tonnage and 66 percent of the value of all California clay production. Fire clay and ball clay outputs represented most of the remainder. Fuller's earth was mined at only one property, in Inyo County. Three mines in San Bernardino County and one each in Imperial, Inyo, and San Benito Counties yielded all the bentonite. Kaolin was dug from one deposit in Mono County and at two locations in Orange County.

Hectorite, a unique variety of montmorillonite clay containing lithium, was mined underground near Newberry, San Bernardino County, by National Lead Co. and Inerto Co. The crude mineral was processed in California and Texas plants principally for use in clarifying liquids, and in the manufacture of pharmaceuticals and cosmetics. Both operators planned to expand and convert to open-pit operations.

TABLE 8.—Source and destination of shipments of portland cement

(Thousand barrels)

Destination	Source				Total	
	Northern California mills		Southern California mills			
	1961	1962	1961	1962	1961	1962
Northern California	13,931	14,083	408	390	14,339	14,473
Southern California	657	653	22,638	24,625	23,295	25,278
Nevada	331	411	630	1,165	961	1,576
Oregon	704	(1)		(1)	704	(2)
Arizona			445	115	445	115
Utah			23	23	23	23
Other	1,321	[3] 2,198	2	[4] 4	1,323	2,202
Total	16,944	17,345	24,146	26,322	41,090	43,667
Building material dealers	1,369	1,578	3,106	3,318	4,475	4,896
Concrete product manufacturers	1,593	1,501	2,338	2,512	3,931	4,013
Ready-mixed concrete	10,949	11,225	16,135	18,283	27,084	29,508
Contractors and Government agencies	2,896	2,992	2,397	2,029	5,293	5,021
Miscellaneous and own use	137	49	170	180	307	229
Total	16,944	17,345	24,146	26,322	41,090	43,667

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Included with "Other"; total 958,000 barrels shipped from northern and southern California to Oregon.
[3] Includes Oregon, Washington, Montana, Alaska, Hawaii, and foreign countries.
[4] Includes Oregon, Washington, Idaho, Colorado, Hawaii, and foreign countries.

TABLE 9.—Clays production, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Amador	71,173	$143,378	(1)	(1)
Contra Costa	(1)	(1)	58,401	$87,850
Imperial			405	3,067
Inyo	5,481	33,713	(1)	(1)
Kern	(1)	126,666	75,772	129,381
Los Angeles	373,214	459,358	437,124	575,637
Madera	7,500	9,375	7,314	9,143
Orange	43,891	250,617	89,956	417,680
Riverside	471,365	1,301,988	538,432	1,361,657
Sacramento	27,964	40,471	25,300	34,302
San Bernardino	262,829	673,726	144,024	477,971
San Diego	26,500	26,500	(1)	(1)
San Joaquin	44,738	69,424	23,738	37,761
San Luis Obispo	8,873	11,091	9,675	12,094
Santa Clara	29,269	41,298	22,100	22,100
Sonoma			32,787	13,115
Stanislaus	6,767	47,405	(1)	(1)
Tulare	1,700	2,500	2,000	2,500
Undistributed [2]	1,660,342	3,167,479	1,669,974	4,164,662
Total	3,041,606	6,404,989	3,137,002	7,348,920

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes Alameda, Calaveras, Fresno, Marin, Mono, Napa, Placer, San Benito, San Mateo, Santa Cruz, Shasta (1962), Sutter, Tuolumne, Ventura, and Yuba Counties, and counties indicated by footnote 1.

Diatomite.—Most of the diatomite production came from three open-pit operations in Santa Barbara County. In Napa County diatomaceous silica was mined and processed for use as pozzolan in concrete products. Sales were up 6 percent in quantity and 2 percent in value. The demand for prepared material was greatest in filtration and filler uses. Lesser tonnages were sold for use as lightweight aggregate, in insulation, and in pozzolan cement. In all instances preparation plants were at or near the pit sites.

Feldspar.—The feldspathic dune sands of the Monterey peninsula were mined and processed by Del Monte Properties Co. and Owens-Illinois Glass Co., primarily for their feldspar content. Del Monte used froth flotation to remove heavy minerals and to produce feldspar and silica concentrates and a silica-feldspar mixture. The concentrates were blended and ground to customer specifications. Consumer uses included sanitary ware, ceramics, pottery, glass, abrasives, and foundry products. Owens-Illinois used magnetic separators to remove heavy minerals and shipped the feldspathic sand to its glass-manufacturing plants.

Gem Stones.—Commercial and amateur collectors, mineralogical societies and clubs, and gem dealers collected over 80 varieties of gem materials and mineral specimens in 34 counties. Principal gem materials gathered were obsidian, marble, wonderstone, jade, agate, jasper, and mariposite. The greatest variety came from Inyo County, followed by Riverside, San Bernardino, Kern, and Butte Counties. Large quantities of obsidian were gathered in the Davis Creek and Lassen Creek areas of Modoc County. Deposits in the Panamint Valley and Panamint Range, Inyo County, yielded most of the marble and wonderstone. Jade was found in Butte and Riverside Counties; agate in Kern, Los Angeles, Riverside, and San Bernardino Counties; jasper in Colusa, Kern, and San Bernardino Counties; and mariposite in Mariposa County. Other varieties of gem materials and specimens included significant quantities of actinolite, dolomite, epidote, garnet, halite, howlite, idocrase, marcasite, onyx, opal, petrified wood, quartz crystal, rhodonite, topaz, tourmaline, travertine, and turquoise.

Gypsum.—Favorable weather and a high level of building activity in southern California were chiefly responsible for a record gypsum production of 1.75 million tons, up 4 percent from the previous high in 1959. Kern County deposits yielded 855,000 tons of crude gypsum which was sold principally to cotton and potato growers in the San Joaquin Valley for soil conditioning. Agricultural gypsum also was mined in Imperial, Kings, Merced, Riverside, San Luis Obispo, and Santa Barbara Counties. Chemical and fertilizer plants in Alameda, Fresno, and San Joaquin Counties were sources for byproduct gypsum produced for agricultural use. Over 1.1 million tons of agricultural gypsum, from California and out-of-State mines, was sold in the State during 1962.

Mines in Imperial, Kern, Riverside, and Ventura Counties supplied gypsum for the manufacture of plaster and wallboard and for use as a cement retarder. Calcining plants in Alameda, Contra Costa, Imperial, Los Angeles, and Riverside Counties consumed substantial tonnages of gypsum received from mines in California and Nevada and imported from Mexico.

Iodine.—All domestic production of crude iodine was by Dow Chemical Co. and most of it was recovered from waste oil-well brines of the Los Angeles basin in the company's Seal Beach plant, Orange County. Although output was slightly higher than in 1961, a company report indicated plans had been made to transfer all production to its Michigan plant by September 1964.

The company consumed crude iodine in the maufacture of titanium tetraiodide and potassium iodide at Seal Beach in 1962. At Compton, Los Angeles County, Deepwater Chemical Co. produced potassium, sodium, and silver iodide; potassium and calcium iodate; and resublimed iodine from purchased crude iodine.

Lime.—Producers of lime sold 131,000 tons and used 339,000 tons, compared with 140,000 and 363,000 tons, respectively, in 1961. The declines in sales and consumption occurred mainly at plants producing quicklime for refractory use and for extracting magnesia from sea water. Sales of agricultural lime, and construction lime, also were lower than in 1961. Commercial producers of lime for agricultural and other industrial and chemical markets operated plants in El Dorado, Monterey, San Bernardino, and Tuolumne Counties. The Natividad plant in Monterey County was the State's largest lime-producing operation. Kilns at sugar refineries in Alameda, Glenn, Imperial, Monterey, Orange, San Joaquin, Santa Barbara, and Yolo Counties yielded 146,000 tons of lime used in recovering sugar from sugarbeet molasses. Limekilns were also operated at a pulp mill in Contra Costa County and a water-treatment plant in San Diego County.

Lithium Minerals and Compounds.—Searles Lake brines, San Bernardino County, yielded crude dilithium-sodium phosphate in the Trona plant of American Potash & Chemical Co. Plant output was slightly below that of 1961. The crude phosphate was converted to lithium carbonate and marketed chiefly for use in compounding enamel frits. Lithium carbonate lowers the melting point of frits and improves the thermal shock and acid resistance of the enamel.

Magnesium Compounds.—Sales and producer consumption of magnesium compounds dropped nearly 16 percent from 1961. The entire decline was attributed to reduced sales of refractory magnesia. Inorganic Chemical (Mineral Products) Division, FMC Corp., treated saltworks bitterns from nearby salt producers to extract magnesium hydroxide in an Alameda County plant and magnesium chloride in a San Diego County plant. Magnesium hydroxide was recovered from sea water in extraction plants in San Mateo and Monterey Counties by Merck & Co., Inc., and Kaiser Aluminum and Chemical Corp., respectively, using calcined dolomite and limestone. Kaiser consumed most of its output in the manufacture of refractories, principally for the iron and steel industry.

Mica.—Crude mica (sericite schist) was produced from only one deposit. Western Non-Metallics mined and ground the crude mineral near Ogilby, Imperial County, and shipped the product to California and Oregon manufacturers of roofing materials. At Los Nietos, Los Angeles County, Sunshine Mica Co. dry-ground scrap mica received from South Dakota and Colorado and imported from India. The ground product was consumed by paint and roofing industries.

Perlite.—As in 1961, crude perlite production was limited to two deposits, the Fish Springs quarry, Inyo County, and the Alvo mine, Napa County. Production and shipments of the crude material, and sales of expanded perlite, were greater than in 1961. Purchases of crude perlite by expanding plants also increased. More than half the crude was purchased from producers in Nevada and New Mexico. The number of operating plants was unchanged at 11. Only one, in Napa County, was captive. About 52 percent of the expanded perlite was consumed as plaster aggregate, 14 percent in filter aids, 9 percent in insulation, 5 percent as a soil conditioner, 5 percent in concrete aggregate, and 15 percent in all other uses.

Potassium Salts.—American Potash & Chemical Corp. produced nearly all the California output of potassium compounds as muriate of potash (potassium chloride) from Searles Lake brines in its Trona plant, San Bernardino County. Some of the muriate was converted to potassium sulfate by the producer. Output increased 21 percent compared with that of 1961. A relatively small quantity of cement plant fluedust, obtained from its Davenport plant, Santa Cruz County, by Agricultural Minerals & Mineral Feeds, was sold for use as a soil aid because of its potash content.

The California State Bureau of Chemistry reported that 1,831 tons of potassium chloride and 8,564 tons of potassium sulfate were sold for direct application to the soil; additional quantities were used to produce commercial fertilizers. Potassium compounds, chiefly potassium chloride, were exported from Los Angeles and San Diego ports to Japan, Sweden, Mexico, and the Philippine Islands.

Pumice.—Production of pumice, pumicite, and volcanic cinder was about 37,000 tons below that of 1961. The decline was due largely to the greatly reduced tonnages of volcanic cinder used in road maintenance and construction in Lassen County and for railroad ballast in San Bernardino County. The increased use of this material by the railroads in Siskiyou County, and by road agencies in Shasta County, did not offset the overall drop for these uses. Lesser tonnages also were required for cleansing and scouring compounds and other abrasive uses. There was a greater demand, principally for volcanic cinder, as lightweight aggregate for concrete and plaster, as a soil conditioner for decorative use (landscaping), and as a carrier in pesticides. Nearly 54 percent of the total output was sold or used as prepared material (crushed, screened, and/or ground before shipment).

Pyrite.—Mountain Copper Co. produced the State's entire pyrite output from its Hornet mine, Shasta County. Production and shipments declined 43 and 64 percent, respectively. The pyrite was sold to chemical plants in Contra Costa County for its sulfur content. The resulting cinder was marketed as an additive in quick-setting cement. The company closed its pyrite operation at yearend due to an unfavorable market condition brought about by the competition of cheaper sulfur available from other sources. Yearend stocks were to be sold in 1963.

Salt.—There was no change in the number of producers and plants or in the location of plants, compared with 1961. At Moss Landing,

TABLE 10.—Pumice[1] sold or used by producers in 1962, by counties

County	Crude		Prepared		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Imperial			354	$1,064	354	$1,064
Lessen			16,914	42,882	16,914	42,882
Modoc			97,092	202,419	97,092	202,419
San Bernardino			43,983	118,716	43,983	118,716
Santa Clara			100	1,200	100	1,200
Shasta	131,763	$263,836	192	384	131,955	264,220
Siskiyou	115,965	232,622	46,153	85,585	162,118	318,207
Tehama			3,766	7,532	3,766	7,532
Other counties[2]	17,630	301,375	99,287	1,357,452	116,917	1,658,827
Total	265,358	797,833	307,841	1,817,234	573,199	2,615,067

[1] Includes pumicite and volcanic cinder.
[2] Includes Calaveras, Inyo, Kern, Lake, Madera, and Mono Counties.

Monterey Bay Salt Works was sold early in 1962 to Monterey Bay Salt Co., Inc.

Most of the State output was solar evaporated from sea water in the San Francisco Bay area. Some rock salt was mined in San Bernardino County. About half the California production was consumed in the State. Shipments were made to all western States (except New Mexico), Alaska, and Hawaii, and salt was exported to Canada, Mexico, countries in the Far East and Central America, and South Pacific islands.

Although the salt was sold for a wide variety of uses, much of the output was consumed in the chemical and food industries and for water treatment.

Sand and Gravel.—The tonnage of sand and gravel sold or used by producers was 2.5 million tons less than the record high in 1961, yet the value of the 1962 output was $800,000 higher. The value rise was due to the overall increase in the quantity of prepared (washed, screened, and crushed) sand and gravel produced (102.3 million tons) in comparison with the total (107.7 million tons). A 2-month construction strike and lockout in northern California adversely affected the 1962 production, which was nearly 8 million tons less than in 1961. Federal installations required less sand and gravel for aggregate material, thereby contributing to the overall decline.

California Division of Highways projects consumed nearly 18 million tons of sand and gravel, 5 million tons more than in 1961. Highway crews and onsite contractors produced about 12 million tons and commercial operations supplied the remainder. Increased outputs were reported for building construction in Los Angeles, Orange, and San Bernardino Counties, and for projects related to dam construction in Butte, Shasta, and Tehama Counties. Production in Los Angeles County was 25.3 million tons for all uses, nearly 24 percent of the State output. Alameda, Orange, San Bernardino, and Ventura Counties each had sand and gravel production in excess of 5 million tons.

Nearly 88.6 million tons of sand and gravel was produced by 390 commercial operations. Twenty-four of these produced over 1 million tons each for a total of 38.2 million tons; 30 preparation plants were in the 500,000- to 1-million-ton range and supplied 17.7 million tons; 109 operations yielded between 100,000 and 500,000 tons each for a

total of 25.3 million tons; and 227 operators produced less than 100,000 tons each, totaling 7.4 million tons. Output of ground and unground industrial sands gained 2 percent in quantity over 1961. An increase in demand for sand used in glass, and for furnace, filtration, and filter purposes more than offset a substantial drop in requirements for molding, blast, abrasive, and other industrial sands.

Slag (Iron-Blast-Furnace).—The blast furnaces at the Fontana plant of Kaiser Steel Corp. generated slag expanded by the company's North Hollywood Block division, and by the Mineral Wool Insulations Division, American Gypsum Co., for lightweight concrete aggregate. The latter also sold granulated slag for roofing, insulation, railroad ballast, paving material, and sewage filter media. The tonnage of slag sold and used was 47 percent higher than in 1961.

Sodium Compounds.—An overall decline in the production of sodium compounds, compared with 1961, was attributed to reduced output of sodium sulfate (salt cake). Increases were reported for sodium carbonate (soda ash) and glauber salt. Pittsburgh Plate Glass Co. produced anhydrous sodium carbonate and sodium sesquicarbonate from Owens Lake brines, Inyo County. U.S. Borax & Chemical Corp. produced anhydrous sodium sulfate at its Wilmington, Los Angeles County, refinery from borates mined and partly refined in Kern County. American Potash and Chemical Corp. and West End Chemical Co., division of Stauffer Chemical Co., recovered sodium carbonate (soda ash and trona) and sodium sulfate (salt cake) through processing Searles Lake brines, San Bernardino County, in plants at Trona and West End, respectively. Glauber salt was also produced at the latter plant. Stauffer Chemical Co. recovered byproduct sodium sulfate at its San Francisco plant from purchased Kern County borates. A freight advantage on Wyoming-produced sodium carbonate (trona) adversely affected out-of-State sales of California soda ash.

Stone.—Nearly 1 million tons more stone was quarried and crushed than in 1961. The value of the output rose by a greater percentage than the tonnage, principally because greater quantities of specification concrete aggregate were required. Substantially larger tonnages of stone were prepared for road base in Kern and Santa Clara Counties. More stone was quarried for rubble for use in foundations and for harbor development. Stone required for riprap was about 1.1 million tons less due to completion of several dams late in 1961 and to more sand and gravel being used instead of stone for aggregate in concrete tunnels and canal linings at reservoir sites. Lesser quantities of granite, limestone, and sandstone were produced in El Dorado, Tulare, and Alameda Counties, respectively, where extensive use had been made of these materials at Government projects in 1961.

Higher outputs of terrazzo and roofing granules at marble quarries in Inyo, Tuolumne, and San Bernardino Counties offset a decline in production of dimension marble for building stone, and the unit value of marble was appreciably higher. Outputs of slate flour in El Dorado County, slate flagging in Mariposa County, and oystershell from San Francisco Bay were above the 1961 figures. Producers of natural and artificially colored roofing granules—from stone, slag, gravel, and volcanic cinder—reported higher tonnages than in 1961.

TABLE 11.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Sand		Grave		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	27,217	$28,674	44,635	$45,674	71,852	$74,348
1958	30,810	34,710	53,327	60,630	84,137	95,340
1959	34,101	41,583	53,844	67,326	87,945	108,909
1960	36,524	46,000	51,155	61,503	87,679	107,503
1961	42,379	51,080	67,802	73,031	110,181	124,111
1962	47,463	54,293	60,197	70,629	107,660	124,922

TABLE 12.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Glass	(1)	(1)	676	$3,491
Molding	(1)	(1)	26	116
Building	20,446	$25,150	23,077	27,024
Paving	9,170	10,004	11,140	11,778
Blast	219	811	212	767
Engine	(1)	(1)	55	178
Filter	(1)	(1)	9	54
Other	5,004	7,135	3,880	3,504
Total	34,839	43,100	39,075	46,912
Gravel:				
Building	23,833	32,076	23,262	29,566
Paving	23,437	28,027	23,984	28,875
Railroad ballast	222	243	398	418
Other	3,715	3,707	1,853	1,752
Total	51,207	64,053	49,497	60,611
Total sand and gravel	86,046	107,153	88,572	107,523
Government-and-contractor operations: [2]				
Sand:				
Building	42	94	59	77
Paving	6,957	7,365	7,615	6,681
Fill	539	519	707	614
Other	2	2	7	9
Total	7,540	7,980	8,388	7,381
Gravel:				
Building	54	98	2,576	2,046
Paving	15,922	8,405	7,486	7,494
Fill	477	332	532	368
Other	142	143	106	110
Total	16,595	8,978	10,700	10,018
Total sand and gravel	24,135	16,958	19,088	17,399
All operations:				
Sand	42,379	51,080	47,463	54,293
Gravel	67,802	73,031	60,197	70,629
Grand total	110,181	124,111	107,660	124,922

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes figures for States, counties, municipalities, and other Government agencies.

TABLE 13.—Sand and gravel production in 1962, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Alameda	8,281	$12,396	Plumas	204	$281
Butte	1,857	1,895	Riverside	1,956	3,218
Calaveras	107	284	Sacramento	4,392	7,219
Colusa	418	359	San Benito	362	446
Contra Costa	226	289	San Bernardino	6,387	6,141
Del Norte	293	296	San Diego	4,229	8,195
El Dorado	521	708	San Joaquin	2,315	3,513
Fresno	4,512	4,824	San Luis Obispo	802	845
Glenn	373	408	Santa Barbara	1,938	2,270
Humboldt	1,494	1,219	Santa Clara	3,135	2,497
Imperial	888	968	Santa Cruz	786	1,097
Inyo	349	374	Shasta	1,178	1,315
Kern	3,510	4,399	Sierra	62	59
Kings	1,758	1,825	Siskiyou	146	198
Lake	189	219	Solano	122	149
Lassen	247	230	Sonoma	2,822	3,051
Los Angeles	25,619	23,151	Stanislaus	936	1,021
Madera	269	226	Sutter	211	146
Mariposa	58	97	Tehama	2,375	1,770
Mendocino	504	625	Trinity	152	238
Merced	1,336	1,381	Tulare	1,867	2,200
Modoc	355	484	Tuolumne	5	9
Mono	9	9	Ventura	4,541	5,039
Monterey	815	1,771	Yolo	1,650	2,412
Napa	100	134	Yuba	526	694
Nevada	324	505	Other counties [1]	998	2,487
Orange	8,512	8,485			
Placer	639	856	Total	107,660	124,922

[1] Includes Alpine, Amador, Marin, San Francisco, and San Mateo Counties, combined to avoid disclosing individual company confidential data.

TABLE 14.—Stone sold or used by producers, by uses

Use	1961		1962	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble—short tons	83,458	$729,930	168,986	$935,180
Rough architectural—cubic feet	134,879	[1] 704,865	([1] [2])	([1] [2])
Approximate equivalent—short tons	11,220		([1] [2])	
Monuments and mausoleums—cubic feet	36,767	289,240	112,569	1,020,649
Approximate equivalent—short tons	3,093		9,371	
Flagging—cubic feet	22,197	51,312	53,593	100,355
Approximate equivalent—short tons	1,856		4,541	
Total dimension stone, approximate—do	99,627	1,775,347	182,898	2,056,184
Crushed and broken stone:				
Riprap—short tons	5,108,014	7,446,743	3,970,336	7,240,417
Metallurgical—do	([3])	([3])	([3])	289,830
Concrete and roadstone—do	11,483,138	14,441,914	13,061,251	16,486,880
Railroad ballast—do	([3])	([3])	([3])	([3])
Agricultural—do	([3])	([3])	([3])	([3])
Chemical and refractories—do	25,955	249,148	28,500	338,226
Miscellaneous [4]—do	[5] 17,133,468	[5] 26,413,419	[6] 17,533,387	28,310,555
Total crushed and broken stone—do	33,750,575	48,551,224	34,593,474	52,665,908
Grand total, approximate—do	33,850,202	50,326,571	34,776,372	54,722,092

[1] Includes dressed architectural, roofing slate, and mill stock.
[2] Included with monuments and mausoleums to avoid disclosing individual company confidential data.
[3] Included with "Miscellaneous" to avoid disclosing individual company confidential data.
[4] Includes whiting substitute, filler, mineral food, poultry grit, stucco, roofing granules, filter beds, terrazzo, metallurgical, railroad ballast, agricultural, chemical, and miscellaneous uses.
[5] Includes 11,399,184 short tons of revised limestone and oystershell used in cement valued at $12,841,010 and 742,458 tons of limestone used in lime valued at $2,006,600.
[6] Includes 12,216,045 short tons of limestone and oystershell used in cement valued at $13,733,543 and 582,466 tons of limestone used in lime valued at $1,659,642.

TABLE 15.—Stone [1] production in 1962, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Alameda	1,461	$1,319	Plumas	5	$7
Amador	(2)	(2)	Riverside	1,712	4,486
Butte	198	317	San Benito	(2)	(2)
Calaveras	(2)	(2)	San Bernardino	4,944	7,819
Contra Costa	2,415	3,122	San Diego	1,170	1,726
Del Norte	46	47	San Francisco	(2)	(2)
El Dorado	1,037	2,147	San Luis Obispo	310	1,110
Fresno	554	885	San Mateo	1,882	2,007
Glenn	3	5	Santa Barbara	(2)	(2)
Humboldt	235	378	Santa Clara	4,141	2,948
Imperial	75	63	Santa Cruz	(2)	(2)
Inyo	(2)	604	Shasta	591	1,245
Kern	3,346	5,652	Sierra	7	26
Lake	8	10	Siskiyou	11	16
Lassen	27	20	Solano	91	122
Los Angeles	2,640	5,133	Sonoma	170	281
Madera	9	(2)	Sutter	62	34
Marin	(2)	(2)	Tehama	309	361
Mariposa	1	17	Trinity	49	32
Mendocino	77	123	Tulare	294	449
Merced	37	40	Tuolumne	364	1,247
Modoc	69	137	Ventura	148	603
Monterey	(2)	(2)	Yuba	61	77
Napa	(2)	(2)	Other counties [3]	5,956	9,849
Nevada	167	97			
Orange	94	161	Total	34,776	54,722
Placer	(2)	(2)			

[1] Includes stone used in cement and lime.
[2] Included with "Other counties" to avoid disclosing individual company confidential data.
[3] Includes Amador, Calaveras, Marin, Monterey, Napa, Placer, San Benito, San Francisco, Santa Barbara, and Santa Cruz.

TABLE 16.—Stone sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Granite		Basalt and related rocks (traprock)		Limestone [1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1958	3,649	$5,348	1,499	$1,738	14,409	$22,584
1959	4,343	5,433	1,772	2,728	16,137	24,384
1960	4,208	5,409	1,941	2,748	15,054	23,311
1961	4,867	7,233	1,880	2,225	16,669	23,989
1962	4,484	5,975	1,886	2,200	15,694	24,082

Year	Sandstone		Other stone [2]		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1958	3,933	$5,688	8,933	$12,987	32,423	$48,345
1959	2,758	4,506	7,124	12,039	32,134	49,090
1960	3,541	5,626	8,331	12,748	33,075	49,842
1961	3,286	5,222	7,148	11,658	33,850	50,327
1962	2,399	4,038	10,313	18,427	34,776	54,722

[1] Includes limestone and oystershell used in cement and lime as follows (in thousand short tons and thousand dollars): 1958, 12,352 tons, $16,422; 1959, 13,663 tons, $16,628; 1960, 12,605 tons, $16,645; 1961, 12,778 tons, $15,312; 1962, 12,799 tons, $15,393.
[2] Includes light-colored volcanics, schist, serpentine, river boulders, and such other stone as cannot properly be classed in any main group; also marble and slate.

Sulfur.—Five plants in California recovered elemental sulfur as a byproduct of petroleum refining. Three of the plants were in Los Angeles County: Collier Carbon & Chemical Corp. near Wilmington and Wilshire Oil Co. of California at Santa Fe Springs, both using the modified Claus process, and Hancock Chemical Co. at Long Beach, using the Simon-Carves process. Union Oil Co. of California also used the modified Claus process in recovering sulfur at plants in Rodeo, Contra Costa County, and Arroyo Grande, Santa Barbara County. Production of elemental sulfur from all sources (includes production of brimstone recovered as a byproduct in the liquid purification of gas and the sulfur in the form of native ore) declined 25 percent from that of 1961, the tonnage shipped was up 1 percent and the corresponding value down 7 percent.

Sulfur ores used in the manufacture of sulfuric acid at Yerington, Nevada, were exhausted by the mining of the last 150,000 tons from the Leviathan sulfur mine, Alpine County, and the property was sold. Sulfur ores were mined at the Crater Sulphur deposit, Inyo County, and the S Bar S mine, Lake County, for use in soil treatment. The Sulphur Bank mine, Lake County, was idle throughout 1962. The quantity and value of all sulfur ore shipments declined 16 percent from 1961 figures.

Talc, Soapstone, and Pyrophyllite.—Output of these minerals declined 27 percent in quantity and 12 percent in value, and sales to consumers dropped markedly from 1961. Stockpile withdrawals were made during the year as shipments to grinders exceeded production. Talc was shipped from 12 mines each in Inyo and San Bernardino Counties, soapstone from 2 properties in Amador County and 1 each in El Dorado and Los Angeles Counties, and pyrophyllite from 1 deposit in Mono County and 3 in San Diego County. The ceramic industry consumed 48 percent of the total used, paints 22 percent, insecticides 10 percent, rubber 3 percent, and polishing, textiles, and toiletries, the balance. Talc was the only one of the three minerals exported.

Vermiculite.—Crude vermiculite imported from Africa was exfoliated in an Orange County plant by Lahabralite Co., and California Zonolite Co. operated exfoliation plants in Los Angeles and Sacramento Counties on crude vermiculite received from its Montana mines. Plant products were used for thermal and acoustical insulation, as plaster and concrete aggregate, and in soil-conditioning products. The quantity sold for construction uses was three times that in 1961, although the value of sales was slightly lower.

Water.—Pacific Gas and Electric Co. announced in December that a second 12,500-kilowatt geothermal unit was nearing completion at its Geysers power plant, Sonoma County, and was expected to be in operation by June 1963.

During 1962, 16 wells were drilled in the State in search of steam sources for geothermal power. Magma Power Co. and associated companies drilled 13 wells: 5 in Mono County, 1 in Lassen County, 3 in Modoc County, and 1 in Inyo County. Two wells were drilled in Imperial County, one by O'Neill Geothermal, Inc., and one by Western Geothermal, Inc. Geyser Steam Co. drilled a well in the Terminal Geyser area, Plumas County. Although the drilling activity was widespread, the centers of interest appeared to be around the

Niland (Salton Sea) area, Imperial County, and the Casa Diablo area, Mono County. In both instances, brines that accompanied the steam became of prime importance. Hot brines from the O'Neill well near Niland were of particular interest as a possible source for minerals, and at year end attempts were being made to establish a commercial project for minerals recovery. The brines of the Magma wells in the Casa Diablo area, Mono County, were of special interest for an entirely different reason. Crowley Lake is the drainage area for the Casa Diablo region and the minerals in the well brines would be a pollution problem that could be very difficult to solve.

In October, the Office of Saline Water, U.S. Department of the Interior, announced a number of contracts and contract renewals with California companies, research organizations, and outside firms operating in the State. Among these were University of California, Berkeley, Calif., research in salt transport mechanisms and tolerance of plants; Aerojet General Corp., Azusa, Calif., fundamental study of mechanism of water transport and ion migration through membranes; Burns & Roe, Inc., New York, maintenance and operation of the Department of the Interior demonstration plant at Point Loma, San Diego, Calif.; Narmco Research & Development, San Diego, Calif., influence of materials and operational variables on the effectiveness and performance of the vapor-gap asmotic distillation process (State of California to pay half the contract cost); Leslie Salt Co., San Francisco, Calif., technical and economic feasibility of recovering fresh water from sea water in conjunction with solar salt-producing operations; and FMC Corp., San Jose, Calif., investigating and analysis of heat-exchange systems without metallic heat-exchange surface for use with vapor reheat and other distillation processes. The Office of Saline Water also announced plans to increase the capacity of the Loma Point plant to convert sea water to fresh water from 1 to 1.4 million gallons a day early in 1963.

Other Nonmetals.—California chemical companies purchased phosphate rock from Idaho and Wyoming producers and used it in the manufacture of phosphoric acid and other phosphate fertilizers and chemicals. Apparent consumption of domestic rock, based on purchases, rose more than 8 percent above that of 1961. Collier Carbon & Chemical Co. had leased about 30,000 acres of phosphorite nodule deposits between San Diego and San Clemente Island in 1961. During 1962, the company made some trial runs at recovering the mineral and discovered contamination by a variety of unexplored ordnance material from the nearby Naval range impact area. Collier submitted a request to BLM for return of its payment, but the request had not been acted upon at yearend.

All the iron oxide pigments produced in the State were prepared in the Alameda County plant of C. K. Williams Co. Most of the plant output was manufactured black, brown, red and yellow iron oxides, but the company also used hematite and limonite from out-of-State sources to produce natural brown and red iron oxides, Venetian red, ocher, sienna (burnt and raw), and umber (burnt and raw).

No activity other than assessment work was reported by owners of garnet claims, Inyo County; at amorphous silica property, San Bernardino County; and a celestite deposit, San Diego County. The

Desert Rat aluminum silicate claims, Riverside County, were abandoned. Three operators in the Midland area, Riverside County, collected and shipped wollastonite float for use as decorative and landscaping stone.

METALS

Beryllium.—Exploration was conducted on beryl-bearing pegmatites north of Jacumba in the Tule Mountains, San Diego County, and the Bureau of Mines continued its investigations of reported beryllium occurrences in California. Gem beryl was produced from pegmatites in the Pala district, San Diego County, but little other activity was reported by property owners.

Copper.—Six copper mines and prospects were active all or part of the year, but only two, the Copper Bluff, Humboldt County, and the Engels, Plumas County, contributed appreciable quantities to the total metal recovered. Most of the output was obtained as a by-product during treatment of tungsten ores, Inyo County; a lesser quantity was recovered as copper precipitate at a pyrite mine, Shasta County. Both the quantity and value of metal recovered were below corresponding 1961 figures.

Gold.—Gold production in California rose slightly and was over 90 percent of placer origin. Increased placer output accounted for the overall 1962 gain. Placer activity centered about bucketline dredging operations on the Yuba and American Rivers. Dredging on the latter was shut down indefinitely by Natomas Co. in March.

Lode gold output dropped 22 percent; most of the recovered metal came from mines in the Sierra County, copper ore produced in Humboldt County, and the retreatment of old gold tailings in Nevada County.

Iron Ore.—Production and shipments of usable iron ore dropped 20 and 22 percent, respectively. About 18 percent of the total output was direct shipping grade ore. A somewhat depressed steel industry was primarily responsible for the overall decline. Five mines were active, one in Riverside County, and two each in San Bernardino and Shasta Counties. Some direct-shipping grade ore was mined at all but one, the Iron Age mine, San Bernardino County. Mine-run ores from the Iron Age and the Eagle Mountain property (Riverside County) were upgraded in company plants. Nearly 88 percent of all California shipments went to domestic furnaces, 12 percent was exported, and less than 3,400 tons was sold to cement companies. California ports received over 955,000 long tons of iron ore from California and Nevada producers, virtually all of which was exported to Japan.

Kaiser Steel Corp. completed its bulk loading facility at Long Beach which was designed to handle 2 million tons of iron ore, coke, coal, and mill scale a year. Late in 1962 Kaiser placed in operation a large ore-blending system at its Eagle Mountain facilities. Ironex Co. disclosed plans for construction of a beneficiation plant in 1963 and for initial shipments of iron ore early in 1964 from its mine in the Shasta Lake area. All preliminary development work on the property was completed in 1962.

Iron and Steel.—Kaiser Steel Corp. was the State's only pig iron and sinter producer. The company consumed most of the production in

its integrated steel plant at Fontana, San Bernardino County. Columbia-Geneva Division, United States Steel Corp., shipped some pig iron produced in its Utah blast furnaces to company steel furnaces at Pittsburg, Contra Costa County, and Torrance, Los Angeles County. Pig iron production, consumption, and shipments (including exports) declined 19, 17, and 73 percent, respectively, from 1961 figures. Sinter production and consumption also declined by more than 13 percent.

TABLE 17.—Mine production of gold, silver, copper, lead, and zinc in 1962, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value	Troy ounces	Value
Butte	3	(2)	27	$945	5	$5
El Dorado	2	(2)	84	2,940	18	20
Fresno		3	485	16,975	53	58
Inyo	3		(3)	(3)	93,406	101,346
Kern	8	2	164	5,740	216	234
Los Angeles		(2)	198	6,930	26	28
Mariposa	9	3	(3)	(3)	(3)	(3)
Merced		1	46	1,610	4	4
Nevada	3	5	759	26,565	(3)	(3)
Placer	1	4	104	3,640	15	16
Plumas	2	2	54	1,890	(3)	(3)
San Bernardino	2	(2)	83	2,905	7	8
San Diego	1	(2)	9	315	2	2
Shasta	6	1	151	5,285	57	62
Sierra	5	2	6,785	237,475	1,370	1,486
Siskiyou	4	4	76	2,660	14	15
Stanislaus		(2)	2	70		
Trinity	1	4	77	2,695	12	13
Tuolumne	5		32	1,120	71	77
Undistributed [4]	10	6	97,136	3,399,760	37,229	40,394
Total	65	37	106,272	3,719,520	132,505	143,768

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Butte							$950
El Dorado							2,960
Fresno							17,033
Inyo	(3)	(3)	890,000	$81,880	157,500	$18,113	201,339
Kern							5,974
Los Angeles							6,958
Mariposa	400	$123					123
Merced							1,614
Nevada					(3)	(3)	26,565
Placer							3,656
Plumas	(3)	(3)					1,890
San Bernardino	(3)	(3)					2,913
San Diego							317
Shasta	(3)	(3)	(3)	(3)			5,347
Sierra					200	23	238,984
Siskiyou							2,675
Stanislaus							70
Trinity							2,708
Tuolumne	1,400	431			1,800	207	1,835
Undistributed [4]	2,322,200	715,238	20,000	1,840	484,500	55,717	4,212,949
Total	2,324,000	715,792	910,000	83,720	644,000	74,060	4,736,860

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] From property not classed as a mine.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Includes Alpine, Amador, Calaveras, Humboldt, Mono, Sacramento, and Yuba Counties and counties indicated by footnote 3.

TABLE 18.—Gold produced at placer mines, by classes of mines and methods of recovery [1]

Class and method	Mines producing [2]	Number of washing plants (dredges)	Material treated (thousand cubic yards)	Gold recovered		
				Troy ounces	Value	Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucketline dredges:						
1953–57 (average)	3	12	39,730	128,826	$4,508,903	$0.115
1958	3	7	27,513	135,540	4,743,900	.172
1959	2	7	24,528	103,023	3,605,805	.147
1960	2	5	21,020	89,562	3,134,670	.149
1961	2	5	23,651	82,316	2,881,060	.122
1962	(3)	(3)	(3)	(3)	(3)	(3)
Dragline dredges: [4]						
1953–57 (average)	7	7	241	924	32,340	.134
1958	6	6	83	467	16,345	.197
1959	6	6	119	1,405	49,175	.413
1960	13	14	111	1,081	37,835	.340
1961	3	3	493	309	10,815	.022
1962	(3)	(3)	(3)	(3)	(3)	(3)
Suction dredges:						
1953–57 (average)	4	5	24	93	3,269	.136
1958	2	2	2	14	490	.223
1959	3	3	7	68	2,380	.359
1960	2	2	(5)	5	175	.583
1961	5	5	64	22	770	.012
1962	(3)	(3)	(3)	(3)	(3)	(3)
Nonfloating washing plants: [4 6]						
1953–57 (average)	18	22	29	1,696	59,353	2.047
1958	4	15	1	872	30,520	.523
1959	3	11	2	1,201	42,035	.326
1960	2	6	8	365	12,775	.376
1961	6	9	340	557	19,495	.039
1962	(3)	(3)	(3)	(3)	(3)	(3)
Gravel hydraulically handled:						
1953–57 (average)	8	----------	79	224	7,840	.099
1958	6	----------	7	166	5,810	.824
1959	3	----------	4	50	1,750	.417
1960	4	----------	1	11	385	.396
1961	2	----------	2	3	105	.050
1962	(3)	(3)	(3)	(3)	(3)	(3)
Small-scale hand method: [7]						
1953–57 (average)	37	----------	81	1,313	45,969	.568
1958 [8]	39	----------	49	1,177	41,195	.841
1959 [8]	22	----------	30	1,146	40,110	1.405
1960 [8]	26	----------	59	1,111	38,885	.617
1961	27	----------	17	1,105	38,675	.324
1962	(3)	----------	(3)	(3)	(3)	(3)
Underground placers: Drift:						
1953–57 (average)	12	----------	4	168	5,866	1.467
1958	5	----------	(5)	27	945	2.796
1959	3	----------	(5)	9	315	1.432
1960	1	----------	1	44	1,540	1.750
1961	3	----------	1	55	1,925	1.250
1962	(3)	----------	(3)	(3)	(3)	(3)
Grand total placers:						
1953–57 (average)	89	----------	40,188	133,244	4,663,540	.116
1958	65	----------	27,655	138,263	4,839,205	.173
1959	42	----------	24,691	106,902	3,741,570	.152
1960	50	----------	21,201	92,179	3,226,265	.152
1961	48	----------	24,570	84,367	2,952,845	.119
1962	37	----------	18,272	95,918	3,357,130	.182
1848–1962	----------	----------	(9)	68,143,555	1,520,762,071	(9)

[1] For historical data by years, see Minerals Yearbook, Review of 1940, p. 219.
[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[3] Concealed to avoid disclosing individual company data.
[4] Includes commercial rock plants and tungsten mines that produced byproduct gold from gravels; byproduct gold is included with gold recovered, but material treated and average value per cubic yard refer only to straight gold dredging.
[5] Less than 1,000 cubic yards.
[6] Includes all placer operations using power excavator and washing plants both on dry land; when the washing plant is a movable outfit, it is termed "dryland dredge."
[7] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long tons.
[8] Includes gold recovered by electrostatic separation; combined to avoid disclosing individual company confidential data.
[9] Data not available.

TABLE 19.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing [2]		Material sold or treated [3] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
1953–57 (average)	129	89	282	217,783	$7,622	752,111	$681
1958	107	65	139	185,385	6,489	188,260	170
1959	73	42	142	145,270	5,084	172,810	156
1960	83	50	157	123,713	4,330	179,780	163
1961	79	48	46	97,644	3,418	93,351	86
1962	65	37	43	106,272	3,720	132,505	144
1848–1962	-------	-------	(4)	105,908,563	2,408,903	119,150,236	97,077

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	632	$438	6,471	$1,874	4,925	$1,223	$11,838
1958	749	394	140	33	51	10	7,096
1959	663	407	227	52	78	18	5,717
1960	1,087	698	440	103	465	120	5,414
1961	1,382	829	103	21	304	70	4,424
1962	1,162	716	455	84	322	74	4,737
1848–1961	639,932	209,104	263,876	52,446	150,575	35,546	2,803,076

[1] Includes recoverable metal content of gravel washed (placer operations); ore milled; old tailings or slimes retreated; tungsten ore; and ore, old tailings, slag, flue dust, and pyritic ore residue shipped to smelters during calendar year indicated.
[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[3] Does not include gravel washed.
[4] Data not available.

TABLE 20.—Mine production of gold, silver, copper, lead, and zinc in 1962, by types of material processed and methods of recovery, in terms of recoverable metals [1]

Type of material processed, and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation: Ore	6,375	1,179	-------	-------	-------
Cyanidation:					
Ore	-------	-------	-------	-------	-------
Old tailings	95	27	-------	-------	-------
Total	95	27	-------	-------	-------
Total recoverable in bullion	6,470	1,206	-------	-------	-------
Concentration and smelting of concentrates: Ore [1 2]	3,195	88,874	2,246,300	19,400	482,200
Direct smelting:					
Ore	182	34,841	28,800	890,000	159,500
Old tailings	507	2,100	-------	-------	2,300
Copper precipitates	-------	12	48,900	600	-------
Total	689	36,953	77,700	890,600	161,800
Placer	95,918	5,472	-------	-------	-------
Grand total	106,272	132,505	2,324,000	910,000	644,000

[1] Includes gold recovered as "natural gold."
[2] Includes tungsten-ore concentrate.

TABLE 21.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source materials in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Gold	56	32,187	8,183	17,780	1,100	4,900	7,100
Silver	1	20	16	1,070			
Cooper and tungsten ore [2]	6	[3] 7,296	1,538	73,126	2,316,600	15,100	479,400
Lead	1	210	1	323	500	152,100	1,500
Lead-zinc	1	1,770	14	32,607	5,800	737,900	156,000
Total	65	41,483	9,752	124,906	2,324,000	910,000	644,000
Other lode material: Old tailings	([4])	1,459	602	2,127			
Total lode material	65	42,942	10,354	127,033	2,324,000	910,000	644,000
Placer	37	([5])	95,918	5,472			
Total all sources	102	42,942	106,272	132,505	2,324,000	910,000	644,000

[1] Detail will not necessarily add to total, because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Tungsten-ore tonnage not included.
[4] From property not classed as a mine.
[5] 18,494,960 cubic yards. Does not include material washed at commercial gravel plants to produce 571 ounces of byproduct gold and 55 ounces of byproduct silver included in placer totals.

The best information available to the Bureau of Mines indicated that steel furnaces in southern California operated at about 60 percent of capacity in 1962, compared with 40 percent of capacity for furnaces in the San Francisco Bay area. In June Bethlehem Steel Co. began shutting down its open hearth furnaces in South San Francisco. By September 15 all five furnaces had been shut down.

Iron and Steel Scrap.—Despite a decline in pig iron and steel production, ferrous scrap consumption for all uses was less than 1,700 tons under the 1961 figure. Lower consumption at steel furnaces was offset by higher tonnages charged to iron furnaces and increased miscellaneous uses. The steel furnaces of Kaiser Steel Corp. at Fontana, and United States Steel Corp. at Pittsburg and Torrance, used pig iron in addition to home-generated and purchased scrap. All other steel furnaces in California used 100 percent scrap. Home-generated scrap was down 1 percent from 1961 while purchased scrap rose a like percentage. Exports of ferrous scrap were less than half the 1961 tonnage and yearend scrap prices were $7 to $10 a ton less for No. 1 and No. 2 heavy melting at both San Francisco and Los Angeles, and $1 less for No. 1 dealer bundles and $4 to $5 less for No. 2 dealer bundles, than at the same time in 1961.

TABLE 22.—Ferrous scrap and pig iron consumption

(Thousand short tons)

Year	Ferrous scrap	Pig iron	Year	Ferrous scrap	Pig iron
1953-57 (average)	2,597	1,265	1960	2,054	1,650
1958	2,127	1,280	1961	2,250	2,192
1959	2,280	1,379	1962	2,248	1,818

TABLE 23.—Ferrous scrap and pig iron consumption by types of furnaces and miscellaneous uses

(Thousand short tons)

Ferrous scrap and pig iron charged to—	1961	1962	Ferrous scrap and pig iron charged to—	1961	1962
Steel furnaces: [1]			Miscellaneous uses: [3] Scrap	42	46
Scrap	1,876	1,867	Total scrap	2,250	2,248
Pig iron	1,740	1,600	Total pig iron	2,192	1,818
Total	3,616	3,467	Grand total	4,442	4,066
Iron furnaces: [2]					
Scrap	332	335			
Pig iron	452	218			
Total	784	553			

[1] Includes open hearth, electric furnace, and basic oxygen process.
[2] Includes cupola, air, and blast furnaces; also direct castings.
[3] Includes rerolling, copper precipitation, nonferrous, and chemical uses.

Lead.—Production of recoverable lead was more than four times the 1961 figure. Credit for the increase went to the Santa Rosa lead-zinc mine and the Defense lead mine, Inyo County, where ore shipments rose from 55 tons in 1961 to 1,980 tons in 1962. Lode mines in Inyo County accounted for nearly 98 percent of the recoverable lead produced.

Manganese.—The Pioneer mine in the Paymaster district, Imperial County, yielded some oxide manganese ore that was shipped to a Nevada producer of battery-grade manganese dioxide. This was the only reported activity at manganese properties in California during 1962.

Mercury.—The number of active mercury mines was virtually the same as in 1961. However, about 34,000 tons less ore was mined and 2,737 fewer flasks of metal were produced. Shipments were down 1,716 flasks. At four properties mine dump material only was treated to recover mercury and only six mines yielded more than 100 flasks during 1962. Mercury ores at four mines—the New Idria in San Benito County, the Buena Vista in San Luis Obispo County, the New Almaden in Santa Clara County, and the Mt. Jackson in Sonoma County—were furnaced to produce 94 percent of the total mercury recovered.

TABLE 24.—Mercury production, by methods of recovery

Year	Operating mines	Furnaced [1]		Retorted		Unclassified [2] flasks	Total	
		Ore (short tons)	Flasks	Ore (short tons)	Flasks		Flasks	Value [3]
1953–57 (average)	48	103,528	9,756	7,551	1,269	165	11,190	$2,811,920
1958	48	130,560	20,307	10,471	1,594	464	22,365	5,122,927
1959	37	107,072	15,685	12,034	1,271	144	17,100	3,889,908
1960	41	120,714	17,862	4,334	785	117	18,764	3,954,701
1961	36	118,264	17,776	2,431	883	29	18,688	3,692,936
1962	37	79,948	15,407	3,728	496	48	15,951	3,049,991

[1] Includes ore and mercury from dumps not separable.
[2] Includes mercury from miscellaneous dump material, placer, and cleanup operations.
[3] Value calculated at average New York price.

Molybdenum.—Production and shipments of molybdenite and powellite concentrates rose 35 and 49 percent, respectively. These minerals were byproducts obtained in treating tungsten ores from the Pine Creek mine, Inyo County. About 86 percent of the molybdenite and 12 percent of the powellite was shipped for export; the remainder was sold to domestic customers.

Platinum-Group Metals.—A bucketline dredging operation worked stream gravels, ancient river beds, and old tailings along the Yuba River in the Marysville area to recover platinum-group metals as a byproduct in placer gold recovery. Another dredging operation in Sacramento was shut down in February and reported no platinum recovered in 1962.

Rare-Earth Minerals.—Production of bastnaesite concentrate at the Mountain Pass operation, San Bernardino County, of Molybdenum Corporation of America, rose 82 percent and shipments more than doubled those in 1961. All concentrate shipments were to the producers' plant in Washington, Pa. Shipments were higher as a result of growth in demand for rare-earth materials for use in production of ductile iron and establishment of a new market as a polishing material for flat glass.

Silver.—Production of recoverable silver rose appreciably above that of 1961. Placer silver, a coproduct of placer gold mining, was up 3 percent but represented only 4 percent of the total output. The major increase was in lode silver production, where 73 percent was obtained in the treatment of tungsten and lead-zinc ores mined in Inyo County.

Tungsten.—Nine tungsten properties reported activity during 1962, but only three produced and shipped more than 150 units of tungsten trioxide (WO_3). Of the total units produced, the Pine Creek operation of Union Carbide Nuclear Co., Inyo County, yielded nearly 95 percent. Shipments rose 57 percent, and 98 percent of them originated with Union Carbide at Pine Creek. The company also operated an ammonium paratungstate plant at the same location. New Idria Mining and Chemical Co. operated its Strawberry mine and mill, Madera County, part of the year. Tungsten concentrates were sold to Union Carbide or stockpiled at the New Idria chemical plant in Fresno, completed in December. Tungsten concentrates produced at the other active mines were sold to Union Carbide or shipped to a Nevada tungsten carbide plant.

Zinc.—Increased output of recoverable zinc from mines in Inyo County was responsible for a 6-percent rise in zinc output. The increase more than offset the decline in production reported in Humboldt County. More than 98 percent of the zinc recovered in the State came from mines in these two counties.

Other Metals.—No chromite, tin, or uranium ores or concentrates were reported produced or shipped in 1962. Assessment work only was performed at cobalt-nickel prospects in Del Norte, Imperial, and San Diego Counties, an ilmenite-rutile property in Los Angeles County, and at zirconium-hafnium claims in Kern and Placer Counties.

Two titanium dioxide plants were under construction at yearend, E. I. du Pont de Nemours & Co. at Antioch, Contra Costa County, and American Potash & Chemical Corp. at Mohave, Kern County. The

plants were to be completed in 1963; both will use the chloride process and will use rutile imported from Australia as the raw material.

REVIEW BY COUNTIES

Alameda.—Nearly 8.3 million tons of sand and gravel was used in constructing residential and commercial buildings or in freeways of the Oakland, San Leandro, and Fremont areas. Over 8 million tons of the output was prepared by washing, screening, or crushing. Many of the freeway projects included construction of motor vehicle and pedestrian interchanges and retaining walls. The principal sand and gravel sources were alluvial and stream deposits near Pleasanton, Fremont, and Livermore. The demand for stone as road base was lower than in 1961 and the output dropped to 1.5 million tons. Several stone quarries were closed during 1962. Commercial producers of basalt and miscellaneous stone in the Oakland-Hayward-San Leandro-Fremont areas sold larger tonnages of crushed stone in 1962, chiefly for use in paving streets and parking lots and building shopping centers.

Holly Sugar Corp., Alvarado, calcined purchased limestone and produced carbon dioxide gas and lime for its own needs. At its Newark plant, Inorganic Chemicals Divisions, FMC Corp., used dolomite from its San Benito County quarry to produce lime for its own needs and extracted magnesia and bromine from saltworks bitterns purchased from Leslie Salt Co. Synthetic gypsum was a byproduct of the latter operation. FMC also utilized sodium carbonate from Wyoming and phosphate rock from Idaho in producing a variety of phosphate compounds, including phosphoric acid. Fibreboard Paper Products Corp. calcined crude gypsum shipped from its mine in Nevada and produced wallboard at Newark. Crude salt was harvested from several thousand acres of evaporating ponds by Leslie Salt Co. and processed in four company plants in Alameda County. Leslie supplied the nearby Morton Salt Co. plant with crude salt. Miscellaneous clay was mined by E. H. Metcalf at Livermore and sold for use in making brick. Interlocking Roof & Tile Co. and Kraft-tile Co. mined clays near Niles that were used in roofing products and ceramic tile. Fibreboard purchased magnesia for its Emeryville insulation plant and Philadelphia Quartz Co. produced hydrous magnesium sulfate in Berkeley, from magnesite and brucite purchased in Nevada. In Oakland, Chemical & Pigment Co. custom-ground a small tonnage of nonmetallic minerals, and at Emeryville the Anchor Minerals Division, C. K. Williams Co., produced natural and synthetic iron oxide pigments and ground clays and barite for special purposes.

Iron and steel scrap was the metal source for open hearth steel furnaces operated by Judson Steel Corp. in Emeryville and Pacific States Steel Corp. in Union City.

Alpine.—Virtually all the sulfur ore mined in California during 1962 came from the Leviathan mine near Markleeville. The Anaconda Company, owner and operator, reported the mine had been exhausted of sulfur ore of a grade suitable for company use and that the property had been sold to W. C. Mann of Woodfords, Calif.

TABLE 25.—Value of mineral production in California, by counties

County	1961	1962	Minerals produced in 1962 in order of value
Alameda	$20,377,314	$21,163,869	Sand and gravel, salt, stone, magnesium compounds, lime, bromine, clays.
Alpine	(1)	(1)	Sulfur ore, sand and gravel, silver, gold, zinc, lead, copper.
Amador	1,725,090	2,355,271	Sand and gravel, clays, stone, coal (lignite), soapstone, gold, silver.
Butte	6,094,813	4,918,414	Natural gas, sand and gravel, stone, gem stones, gold, silver.
Calaveras	[2] 16,779,608	15,956,574	Cement, stone, sand and gravel, clays, asbestos, gold, pumicite, silver, gem stones, zinc, lead.
Colusa	3,261,387	4,330,091	Natural gas, sand and gravel, gem stones.
Contra Costa	[2] 5,361,536	4,640,618	Stone, natural gas, sand and gravel, clays, peat.
Del Norte	383,930	347,395	Sand and gravel, stone, mercury.
El Dorado	[2] 4,736,699	3,427,639	Stone, sand and gravel, lime, soapstone, gold, gem stones, silver.
Fresno	[2] 86,492,519	87,317,332	Petroleum, natural gas, sand and gravel, natural gas liquids, stone, asbestos, gold, clays, mercury, gem stones, silver.
Glenn	8,242,776	5,799,925	Natural gas, sand and gravel, lime, stone.
Humboldt	2,922,790	2,231,510	Sand and gravel, natural gas, stone, copper, zinc, gold, silver, lead, gem stones.
Imperial	3,180,856	3,157,862	Gypsum, sand and gravel, lime, stone, manganese ore, mica (scrap), clays, pumice, barite, gem stones.
Inyo	[2] 8,427,330	12,749,118	Tungsten, sodium carbonate, molybdenum, talc, stone, copper, sand and gravel, pumice and volcanic cinder, boron minerals, perlite, silver, lead, clays, zinc, sulfur ore, gold, gem stones.
Kern	[2] 349,894,127	352,289,381	Petroleum, boron minerals, natural gas, cement, natural gas liquids, stone, sand and gravel, gypsum, sodium sulfate, salt, clays, carbon dioxide, pumice, mercury, gold, gem stones, tungsten concentrate, silver.
Kings	12,992,480	13,865,827	Natural gas liquids, petroleum, natural gas, sand and gravel, gypsum, mercury.
Lake	572,737	397,371	Sand and gravel, pumicite and volcanic cinder, mercury, stone, sulfur ore, gem stones.
Lassen	788,928	293,160	Sand and gravel, volcanic cinder, stone.
Los Angeles	[2] 241,068,665	262,219,571	Petroleum, natural gas, sand and gravel, natural gas liquids, stone, clays, iodine, gold, gem stones, silver.
Madera	1,488,264	1,672,861	Stone, natural gas, sand and gravel, pumice and pumicite, tungsten, clays, gem stones.
Marin	2,452,974	1,978,405	Stone, sand and gravel, clays, mercury, gem stones.
Mariposa	683,854	131,862	Sand and gravel, gold, stone, gem stones, silver, copper.
Mendocino	626,497	748,620	Sand and gravel, stone, mercury, gem stones.
Merced	1,365,709	1,434,990	Sand and gravel, stone, gypsum, gold, gem stones, silver.
Modoc	406,099	967,696	Sand and gravel, pumice and volcanic cinder, stone, peat, gem stones.
Mono	816,622	1,388,087	Pumice, clays, tungsten, pyrophyllite, sand and gravel, silver, gold.
Monterey	[2] 31,039,216	29,541,395	Petroleum, lime, magnesium compounds, sand and gravel, natural gas, stone, feldspar, salt, gem stones.
Napa	2,485,846	2,356,009	Clays, stone, salt, sand and gravel, asbestos, diatomite, mercury, perlite.
Nevada	551,831	631,661	Sand and gravel, stone, gold, silver, zinc.
Orange	102,654,007	105,009,469	Petroleum, natural gas, sand and gravel, natural gas liquids, clays, stone, lime, salt, iodine, peat.
Placer	1,639,158	1,314,457	Sand and gravel, clays, stone, gold, silver.
Plumas	1,121,885	296,770	Sand and gravel, stone, copper, gold, silver, gem stones.
Riverside	[2] 42,228,548	36,979,294	Iron ore, cement, stone, sand and gravel, clays, gypsum, peat, wollastonite, gem stones, petroleum.
Sacramento	24,680,566	22,050,616	Natural gas, sand and gravel, gold, clays, silver.
San Benito	[2] 9,185,365	8,346,991	Cement, mercury, stone, petroleum, natural gas, sand and gravel, clays, gem stones.
San Bernardino	[2] 85,275,223	96,241,385	Cement, boron minerals, stone, sodium carbonate, potassium salts, sand and gravel, sodium sulfate, salt, iron ore, talc and pyrophyllite, lime, clays, calcium chloride, lithium, bromine, rare earths, petroleum, pumicite and volcanic cinder, natural gas, gem stones, gold, copper, silver.
San Diego	[2] 10,369,057	10,681,866	Sand and gravel, stone, salt, magnesium compounds, clays, pyrophyllite, gem stones, gold, silver.

See footnotes at end of table.

TABLE 25.—Value of mineral production in California, by counties—Continued

County	1961	1962	Minerals produced in 1962 in order of value.
San Francisco	(1)	(1)	Sand and gravel, stone.
San Joaquin	$8,406,301	$10,703,096	Natural gas, sand and gravel, lime, clays.
San Luis Obispo	[2] 6,192,557	7,225,433	Petroleum, stone, sand and gravel, natural gas liquids, mercury, natural gas, gypsum, clays, gem stones.
San Mateo	[2] 12,858,009	13,901,850	Cement, stone, magnesium compounds, salt, petroleum, sand and gravel, clays, natural gas.
Santa Barbara	92,983,403	103,163,735	Petroleum, diatomite, natural gas, natural gas liquids, sand and gravel, stone, lime.
Santa Clara	[2] 27,601,505	26,702,305	Cement, stone, sand and gravel, mercury, clays, volcanic cinder, masonry cement, gem stones.
Santa Cruz	[2] 11,487,493	11,641,490	Cement, stone, sand and gravel, clays, potassium salts.
Shasta	3,676,998	6,166,232	Cement, sand and gravel, stone, pyrites, volcanic cinder, iron ore, clays, copper, gold, silver, lead.
Sierra	365,342	324,030	Gold, sand and gravel, stone, silver, zinc.
Siskiyou	908,806	535,713	Pumice and volcanic cinder, sand and gravel, stone, gold, gem stones, silver.
Solano	11,467,944	11,070,730	Natural gas, sand and gravel, stone, petroleum.
Sonoma	3,690,054	3,560,782	Sand and gravel, stone, mercury, natural gas, clays, gem stones.
Stanislaus	943,081	1,101,556	Sand and gravel, clays, gold.
Sutter	648,389	6,071,675	Natural gas, sand and gravel, stone, clays.
Tehama	1,459,195	2,695,206	Sand and gravel, natural gas, stone, volcanic cinder.
Trinity	364,385	281,045	Sand and gravel, stone, barite, gold, gem stones, silver.
Tulare	9,065,125	4,422,659	Sand and gravel, natural gas, stone, barite, petroleum, clays, gem stones.
Tuolumne	[2] 1,286,670	1,868,238	Stone, lime, sand and gravel, tungsten, clays, gold, copper, zinc, silver.
Ventura	[2] 140,761,923	130,824,018	Petroleum, natural gas, natural gas liquids, sand and gravel, clays, stone, gypsum.
Yolo	4,080,708	(1)	Sand and gravel, natural gas, lime, mercury.
Yuba	2,971,760	3,997,167	Gold, sand and gravel, stone, clays, platinum, silver, copper.
Undistributed [3]	[2] 2,143,046	1,804,678	
Total	[2] 1,435,737,000	1,467,295,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Revised figure.
[3] Includes gem stones, mercury, and tungsten that cannot be assigned to specific counties and value indicated by footnote 1.

Nevada Lumber Co. produced sand and gravel on the Carson River near Hope Valley and prepared the material for use as concrete aggregate. A small tonnage of sand and gravel was produced by State highway crews for road maintenance and by the agency's contractors for road construction near Pickets and Markleeville.

Claude B. Lovestedt worked the Zaca mine in the Monitor area all year. The ore was milled and the concentrate shipped to the Selby smelter, Contra Costa County, for recovery of gold, silver, copper, lead, and zinc.

Amador.—Much of the county's mineral industry was centered about the Ione area. Owens-Illinois Glass Co. mined a clay-sand deposit by dragline. The material was slurried and pumped to a plant for separation of the silica sand and kaolin. The sand was shipped to the company's various glass plants, and the clay slurry was pumped to the nearby clay plant of International Pipe & Ceramics Corp. International was building a new $2 million clay-sand plant, expected to be operating early in 1963, about 2 miles from the Owens-Illinois operation. Clays recovered at the present plant and those mined by Harbison-Walker Refractories Co. and Pacific Clay Products Co. in the same area were used principally in making heavy clay products and refrac-

tories. Pacific Clay also produced miscellaneous clay, and Harbison-Walker quarried quartzite at the Custer deposit east of Ione. The quartzite was used in making silica brick. Mines Engineering & Equipment Co. obtained silica sand at the Empire mine near Plymouth and prepared the material for use as a mineral filler. Sand and gravel produced from the Lancha Plana and Buena Vista deposits was used mostly as fill material. State and county road crews and contractors worked various sand and gravel deposits for material used in the construction and maintenance of roads. Building stone and flagging were produced at a quarry operated by Sierra Madre Stone Co. near Volcano. Soapstone mined from the O'Leary and Rancheria deposits near Sutter Creek was shipped to the Sacramento County grinding plant of Industrial Minerals & Chemical Co. Early in the year Industrial Minerals sold the O'Leary property to R. J. Robideaux.

American Lignite Products Co., Inc., mined lignite near Ione and processed the material in its Buena Vista plant to recover montan wax and other products.

Cleanup operations at the Fremont-Gover gold property in the Drytown area yielded a little gold and silver recovered by amalgamation. Gold ore mined prior to 1948 at the Nevada Wabash mine near Sutter Creek was shipped to the smelter at Selby, Calif. Small quantities of placer gold and silver were recovered by prospectors who worked stream gravels on the Cosumnes River.

Butte.—Natural gas output dropped 29 percent from that of 1961. Only one (Llano Seco) of the county's six dry-gas fields registered a production increase in 1962. An exploratory well in the Wild Goose field was successfully completed, but one drilled in the extreme southwest part of the county reached basement.

Sand and gravel production rose to 1.9 million tons from 1.7 million in 1961. Most of the output was used in constructing buildings and roads in the Chico, Oroville, and Gridley areas, in highway and railroad relocation, and in the concrete lining of a diversion tunnel and other work in connection with the planned Oroville Dam. Contractors and commercial producers supplied aggregate for the Oroville-Wyandotte 65-mile irrigation project along the South Fork of the Feather River. From 1960 to 1962, inclusive, three powerhouses, four major earth and rock-fill dams, and four concrete structures for water-diversion tunnels were built for this project. All the stone quarried was by contractors for the county. The tonnage was substantially lower than in 1961 due chiefly to completion of major highway projects.

Gold and silver were recovered by amalgamation from ores mined in the Canyon Creek and Big Butte Creek areas. Ore from the Black Diamond property in the Butte Creek area was mined in 1955. Gold ore from the Maple Lead mine near Forbestown was shipped to the Selby smelter, Contra Costa County. Numerous prospectors in the Forbestown, Oroville, and Yankee Hill areas recovered small quantities of placer gold and silver from stream gravels.

Calaveras.—Portland cement was produced at the Calaveras Cement Co. wet process plant near San Andreas. Shipments were made by truck and rail to customers in California, Nevada, and Oregon. As part of a long-range program, the company purchased approximately

1,000 acres of land adjacent to its limestone quarry. Reportedly, the land contains a limestone deposit with a tonnage exceeding by many times the quantity used by the company since the cement plant began operating in 1926. Calaveras Cement Co. also mined shale near San Andreas and pumicite from the Wallace deposit for use in making cement. The Wallace deposit will be flooded when the Camanche Dam is completed.

Sand and gravel for concrete aggregate, used in road and building construction, was produced at Neilsen's Gravel Plant, Inc., near San Andreas and by Claude C. Wood Co. and Alfred A. Allen from dredge tailings near Wallace. Pacific Clay Products Co. mined fire clays from deposits near Buena Vista and Valley Springs. The company also produced and prepared glass sand in its Camanche plant until July. At that time the plant was condemned to make way for the Camanche reservoir project. On October 11 the plant and equipment were sold at auction. Larger tonnages of stone were quarried by Government crews and contractors for road construction and maintenance than in 1961. Rhyolite was quarried and crushed for roofing granules at the Kreth Pink pit near Mokelumne Hill and by Ry-Lite Corp. at the Peirano quarry near Altaville. Dimension building stone, road-base material, and roofing granules were produced at the Candy Rock quarry near Avery. Jefferson Lake Asbestos Co. produced several grades of asbestos at its open-pit mine and fiberprocessing facilities near Copperopolis.

Mine dump material and old tailings on the Carson Hill claims, at Carson Hill, and accumulated samples from old gold properties in the county, were treated by amalgamation, or otherwise processed to recover gold and silver. Bench gravels were worked by dragline near Robinson Ferry to recover placer gold and silver. A sluicebox was set up at a sand and gravel nonfloat washing plant on the Mokelumne River near Camanche, and byproduct gold and silver was recovered.

Colusa.—Natural gas production rose 30 percent from that of 1961, chiefly because of output from the Grimes, Grimes West, Kirk, and Buckeye fields. Development drilling was most active in the Grimes and Grimes West fields during 1962. Exploratory drilling resulted in two new field discoveries, the Butte Sink and the Sycamore. In January a new gas pool was discovered in the Compton Landing field, and in September a new pool discovery was made in the 2-month old Butte Sink field.

Building and paving aggregate was produced and prepared at commercial sand and gravel plants operated by Cortina Rock Products at Colusa, and by Goforth Bros. at Williams. Public works crews and contractors obtained sand and gravel for road construction and repair from various stream gravel deposits.

Contra Costa.—Intensified exploratory drilling resulted in three new gasfield discoveries. Of particular significance was the Brentwood field discovery by Shell Oil Co. The field was considered a gas discovery initially but subsequent drilling developed oil production in an area formerly thought to be a dry-gas province. The other new field discoveries were the Concord field by Standard Oil Co. of California, and the Oakley field by Occidental Petroleum Corp. Despite this activity, natural gas output was 47 percent below that in 1961. Pro-

duction from the Los Medanos field was down more than 50 percent and accounted for much of the overall decline. The Concord field was the only new field with recorded production in 1962.

Refineries at Avon and Oleum produced petroleum coke by the fluid and delayed processes, respectively, and recovered hydrogen sulfide gas. Elemental sulfur was extracted from the gas, and at the Selby lead smelter, stack gases were treated to produce liquid sulfur dioxide and sulfuric acid.

At Avon, Tidewater Oil Co. was nearing completion of a hydrocracking unit and related hydrogen supply plant. At Pittsburg, Shell Chemical Corp. produced carbon black as a byproduct in the manufacture of ammonia fertilizers. At Martinez, Mountain Copper Co. reclaimed cement copper from solution residues in its chemical plant. The cement copper was shipped to a smelter in Tacoma, Wash., for recovery of copper, gold, silver, and lead.

Substantial quantities of sand and crushed stone were produced for building construction and road projects. The sand was dredged from the bay or taken from pits near Cowell and Antioch. Basalt rock was quarried near Orinda, sandstone near Richmond and Pacheco, and miscellaneous stone in the Clayton area. The combined output from these quarries exceeded 2.4 million tons. The stone was crushed for use as riprap, road base, railroad ballast, and concrete aggregate. Fibreboard Paper Products Corp. purchased limestone for its Antioch lime plant and used the lime in its sulfate paper-pulp operation. Kaiser Gypsum Co. calcined crude gypsum from Mexico in its Antioch plant for use in making building products. About 25 percent of the crude gypsum was sold for use in cement and as a filler. Kaiser expanded crude perlite from a Nevada mine in the same plant and used it in plaster and wallboard manufacture. National Gypsum Co. took an option on property at Richmond harbor for a proposed board plant which would be the company's first west coast plant. Crude gypsum for the plant would be imported from Mexico. Miscellaneous clay was mined by Port Costa Brick works near Port Costa and by United Materials & Richmond Brick Co., Ltd., near Richmond for use in making building brick. At Richmond, C. Overra & Co. purchased crude barite from a Nevada producer and crushed and sized the mineral for use as aggregate in radiation shielding.

Two operators dredged reed-sedge peat in the San Joaquin River delta. Most of the material was packaged for sale as a soil additive, after drying and shredding.

Del Norte.—Sand and gravel, produced from deposits along the Smith and Klamath Rivers, was used for aggregate in building and road construction projects. The producers operated stationary and portable preparation plants near Crescent City and Smith River. Deposits in the latter area were worked for aggregate used to meet an increased demand for paving material. Government crews and contractors produced sand and gravel at several locations and quarried stone for riprap and road-base material.

Two operators mined and retorted mercury ore at the Webb mine in the Patricks Creek area.

El Dorado.—Larger tonnages of sand and gravel were produced than in 1961, principally by public works crews and contractors, for road

construction west of Placerville and north of Coloma and for access roads for the Sacramento Municipal Utility District. Chris Henningsen & Sons operated a 200-ton-per-hour aggregate plant at Lotus and used dredge tailings to prepare sand and gravel for building and paving purposes. The tonnage of granite quarried for use in the construction of dams and reservoirs was substantially below the 1961 figure. About 400,000 cubic yards of stone was quarried and crushed for use in protecting the Union Valley earth-filled dam. Limestone was quarried by California Rock & Gravel Co. near Cool, by Diamond Springs Lime Co. east of Auburn, and by El Dorado Limestone Co., Inc., at Shingle Springs. Most of the stone was used by the sugar, glass, lime, and agriculture industries. Some of the limestone produced at the quarry sites was prepared for concrete aggregrate and road stone. Placerville Slate Products Co. produced slate granules and flour at its Chili Bar mine and plant north of Placerville. Sierra Placerite Corp. quarried dimension building stone southeast of Placerville. Diamond Springs produced quicklime and hydrated lime, using stone from its own quarry, and sold the products on the open market. Pacific Mineral Products Co. mined soapstone from its Shrub property and shipped it to a grinder in the San Francisco Bay area where it was ground for use in insecticides, ceramics, and rubber products.

Gold ores from the Minnehaha mine near El Dorado, the Short Handle prospect near Summit Hill, and cleanup material at the Cheroni property near Grizzly Flat were treated by amalgamation to recover a few ounces of gold and silver. The stream gravels of the Cosumnes River, and its tributaries, were worked by numerous prospectors who recovered small quantities of placer gold.

Fresno.—Crude petroleum output declined 4 percent from that of 1961. Much of the decline was attributed to the 2,300-barrel-per-day drop in output at the Coalinga East Extension field. In contrast, natural gas production from oil zones rose 4 percent. There were no new field discoveries in 1962, but Sunray DX Oil Co. opened new oil production in the Dessel pool of the Guijarral Hills field and Nordon Corp., Ltd., found gas in the Helm field. Two natural (wet) gas processing plants extracted natural gasoline and cycle products, production of which declined significantly from 1961.

Over 4.5 million tons of sand and gravel was produced and prepared in plants near Fresno, Sanger, Friant, and Coalinga, 2 million tons more than in 1961. Paving projects and highway structures required 3.3 million tons. The largest demand for aggregate was for use in the new six-lane freeway system from Selma to Malaga. Other public works projects in the county required 534,000 tons of stone that was quarried by contractors for use as riprap and road-base material. The State's principal producer of monumental granite was Superior Academy Granite Co. at Academy. Several deposits of decomposed granite near Sanger and Clovis were operated for fill material. Railroad ballast was produced from the Piedra stone quarry, near Sanger, for Santa Fe Railway Co. Production of fusing grade quartz was reported by Pincushion Mining & Development Co. near Huntington Lake.

Asbestos milling plants were completed by Coalinga Asbestos, Inc., northwest of Coalinga and by Atlas Minerals, Inc., about 2 miles far-

ther west. The latter started plant operations in December. Todd Industries, Inc., shipped a small tonnage of fiber from its Coalinga plant, but discontinued operations before yearend. Union Carbide Nuclear Co. continued exploration and development of its asbestos holdings and announced plans to construct a fiber pilot plant south of King City, Monterey County, on U.S. Highway 101. Asbestos Corp. conducted exploratory work and shipped samples for testing from its Lillis Ranch claims in the Big Blue formation.

Craycroft Brick Co. dug clays near Fresno for use in making heavy clay products. Fresno Perlite Corp. expanded crude perlite purchased from California and Nevada producers, and sold the product for plaster aggregate, insulation, and an ingredient in oil-well drilling muds. Crude barite was processed in a Fresno plant for use in paints and well drilling muds. Valley Nitrogen Producers, Inc., at Helm, recovered agricultural gypsum as a byproduct of phosphoric acid manufacture.

Sluice boxes were used at one nonfloat and two dragline sand and gravel preparation plants on the San Joaquin River, near Friant, to recover byproduct placer gold and silver. A small suction dredging operation on the river near Auberry recovered some placer gold from stream gravels. The Mercy mine and the Flying "A" prospect in the Mercy-Hot Springs area each yielded ore that was retorted to recover several flasks of mercury.

Glenn.—Natural dry gas production dropped 35 percent from the 1961 level. Five of the county's eight gas producing areas reported declines in 1962. Nearly 98 percent of the output came from the Beehive Bend field, and production from this field was 33 percent below the 1961 figure. Trico Oil and Gas Co. made a new pool discovery in the Rancho Capay field. Despite the major decline, Glenn County was fifth among 21 dry gas producing counties.

Sand and gravel was produced principally from Stony Creek deposits near Orland and Hamilton City, and at Walker Creek between Willows and Orland. The producers operated stationary and portable plants to prepare the materials for use as road base and for concrete aggregate used in building and paving. Some of the sand and gravel was used in Black Butte Dam structures and water-transmission systems. Gravel was produced at Wyo to provide Southern Pacific Co. with a stockpile of railroad ballast. A small tonnage of stone was quarried by public works crews for use as riprap. Holly Sugar Co., Hamilton City, purchased limestone and produced carbon dioxide and lime used in processing sugar beets.

Humboldt.—Less sand and gravel was produced and used than in 1961, due chiefly to completion of several road construction projects in late 1961 and early 1962. At yearend 1962, several road projects ranging from $2 to $6 million each were pending or under construction near Phillipsville, Meyers Flat, and Field Landing. Production of sand and gravel by contractors at these projects accounted for a large part of the output from plants in the Fortuna-Arcata area. Stone production was substantially above that in 1961 because of the need for riprap by the U.S. Corps of Engineers in a jetty project at Humboldt Bay, and by State and county agencies for road maintenance and repair.

Natural dry gas was withdrawn from the Table Bluff and Tompkins Hill fields. At yearend the two fields had, respectively, 4 and 10 producing wells. The total dry gas production was 1,433 million cubic feet, an increase of 3 percent over that of 1961. Five exploratory wells were drilled, all of which were unsuccessful.

The Copper Bluff mine, the county's only active metal mine, produced for the first 6 months and then was shut down indefinitely. The copper ore was concentrated in the producer's mill and the concentrate shipped to smelters in California, Idaho, and Washington.

Imperial.—U.S. Gypsum Co. mined crude gypsum in the Fish Creek Mountains and hauled it by rail to the company's Plaster City plant. The plant product was used by the producer principally for making plaster and wallboard; some was sold for a soil additive. U.S. Gypsum remodeled its crusher building and improved the plant control system in 1962. Commercial plants and public works crews and contractors obtained sand and gravel from deposits in the Brawley, El Centro, Salton City, and Westmoreland areas. Nearly 800,000 tons of the output was prepared, and about 90,000 tons was sold or used as pit-run material. Owing to a shortage of water at most plant sites, most of the prepared material was screened but not washed. Commercial plants produced 521,000 tons and Government crews and contractors 367,000 tons for road and building construction. Overall production was down 300,000 tons compared with 1961 mainly because of a decline in paving activity in the Salton Sea area during the latter part of 1962. Demand for sand and gravel for building and paving projects in the Brawley area was relatively high throughout the year. Levee projects on the Colorado River required 75,000 tons of stone for riprap that was produced by a contractor for the Bureau of Reclamation.

Gene DeZan reactivated the Pioneer manganese mine in the east-central part of the county and shipped the ore to a Nevada customer. The mine had been idle since 1959.

Holly Sugar Corp. operated a gas-fired kiln at its Carlton plant using purchased limestone to produce its requirements for carbon dioxide gas and lime. Near Ogilby, Western Non-Metallics mined and ground crude mica (sericite schist) for use in making roofing materials. Clays mined near Ocotillo were sold for use as a mineral filler in cattle feed. Aricalite Builders Supply Co. obtained pumice from the Superlite deposits near Calipatria and prepared the material for lightweight concrete aggregate. Organic Mineral Sales, Ltd., mined crude barite from the Hyduke property and shipped it to the Campo mill. The ore had not been ground at yearend.

Inyo.—Union Carbide Nuclear Co. operated its Pine Creek tungsten mine and plant throughout 1962. Ores from this mine yielded the State's entire output of molybdenum concentrate (oxide and sulfide), a high percentage of the recoverable copper (one of two major sources), and nearly half the recoverable lode silver. Two smaller tungsten properties, in the Wildrose Springs area, produced and shipped concentrates to a Nevada processing plant. Lead-zinc ore from the Santa Rosa mine southeast of Keeler and lead ore from the Defense mine east of Darwin were chiefly responsible for the State's increased lead and zinc output. The former mine was active all year, but the latter

produced only in November and December. Stockpiled ore shipped from the Golden Eagle property in the South Park area contained recoverable silver and lead.

Pittsburgh Plate Glass Co. recovered anhydrous sodium carbonate (soda ash) and sodium sesquicarbonate from brines of Owens Lake in its Bartlett plant. Boron minerals were mined in Corkscrew Canyon (DeBely mine) and near Shoshone (Gerstley mine) by U.S. Borax & Chemical Corp. Colemanite (calcium borate) from the DeBely mine and ulexite (sodium-calcium borate) from the Gerstley property were processed in the producer's Kern County refinery. Thirteen talc mines were active. The Warm Spring deposit of Grantham mines was the major producer. Callahan Industrial Minerals Co. worked the White Eagle talc mine and ground talc and soapstone in its Laws plant. At yearend Callahan gave up its option on the former Huntley Industrial Minerals Co. properties and equipment, and all reverted back to Huntley. Sierra Talc Co. ground talc in its Keeler mill and mined fuller's earth from the Olancha deposit southwest of Owens Lake. Anchor Minerals Division, C. K. Williams Co., worked the Ibex bentonite pit near Tecopa, and L. R. Moretti mined bentonite at the Side Hill property in Death Valley. The fuller's earth was processed for use as a carrier in insecticides and fungicides and as a clarifier for vegetable oils. Most of the bentonite was prepared for the pharmaceutical and cosmetic industries, although a small tonnage was used as a sealant in water reservoirs.

Compared with 1961, large quantities of sand and gravel were produced by State highway contractors for road construction in the Little Lake, Lone Pine, and Darwin Junction areas. Stationary plants at Bishop prepared sand and gravel for concrete aggregate, and county and National Park Service crews produced the materials for road maintenance and repair. State and Federal public works crews quarried granite and miscellaneous stone for riprap, road base, and fill. Limestone was quarried near Searles Lake for use by West End Chemical Co. in San Bernardino County. Marble from quarries in the Lone Pine and Ballarat areas was used for rough building stone and was crushed for terrazzo and roofing granules. Quartzite was quarried near Deep Springs for exposed aggregate and near Lone Pine for use in making silica brick. Crownite Corp. mined pumice near Little Lake and sold it for lightweight aggregate and soil conditioning. Volcanic cinder from the same area was used by Redlite Aggregates, Inc., for lightweight aggregate. American Perlite Co. mined crude perlite at its Fish Springs quarry near Big Pine and sold it to expanding plants outside the county. Inyo Soil Sulphur Co. mined sulfur at its Crater Sulphur deposit and prepared the material for agricultural use.

Kern.—Wells in Kern County yielded 90.5 million barrels of crude petroleum, a higher output than that of any other county. However, the output was 2 percent below 1961 production. Interest in some of the older low-gravity wells was revived, and considerable reworking was underway. The methods used to stimulate production in these wells included the use of various down-hole heaters and water and gas injection programs. The Midway-Sunset and Lost Hills fields

were both sites of active in situ combustion projects. A steam-injection project was in progress in the South Belridge field.

Of 79 exploratory wells drilled during 1962, 12 resulted in new discoveries. The Stevens pool discovery in the Asphalto field, between the Midway-Sunset and Elk Hills fields, created considerable interest because of its proximity to an old producing area. The discovery, made by E. A. Bender, was completed, flowing at the rate of 312 barrels per day. Standard Oil Co. of California opened oil production in the new Moco Sand Equivalent pool of the Rass area in the Midway-Sunset field, and Wagenseller & August brought in the new Stockdale field with a well about 2 miles east of the Camfield group.

Kern County also led in production of natural gas from oil zones, although the yield was nearly 8 percent below that of 1961. Significant declines occurred in the North Belridge, Greeley, and Paloma fields. Production of natural dry gas was 2 percent higher. Output from the Buttonwillow field rose 41 percent, that of the Rio Bravo was up slightly, and that of the Semitropic group increased from 3 million cubic feet in 1961 to 282 million cubic feet. Seventeen plants extracted natural gas liquids from natural wet gas, and the combined production for all products was about 6 percent less. Eight refineries with a combined crude oil capacity of 78,852 barrels a day were active, all in the Bakersfield area. Carbon black was produced at plants operated by Continental Carbon Co. at Bakersfield and United Carbon Co. at Mojave. Near Taft, Tidewater Oil Co. extracted carbon dioxide from wet gas in a natural gasoline plant. The volume was double that produced in 1961.

U.S. Borax & Chemical Corp. was the nation's leading producer of boron minerals and compounds. The company mined crude borates from an open pit at Boron and refined or partially refined the minerals in an adjacent plant. The plant also received crude borates from company mines in Inyo County. Some partly refined minerals were shipped to the U.S. Borax refinery in Los Angeles County for further processing. Sodium sulfate also was produced at Boron as a by-product of borate refining. Some crude and partly refined borates were sold to chemical plants outside the county. General Services Administration purchased borate chemicals for the U.S. Forest Service to use as a fire retardant in fighting forest fires. Portland cement was made by California Portland Cement Co. at Mojave (dry process) and by Monolith Cement Co. at Monolith (wet process). The two plants each operated five kilns. Shipments were made by rail and truck to customers in California, Nevada, and Arizona. Nearly 68 percent of all shipments went to operators of ready-mixed concrete plants.

Fixed and portable sand and gravel preparation plants near Bakersfield, Maricopa, and Ridgecrest, and contractors at highway projects near Bakersfield, produced 2.8 million tons of these materials for paving and highway structures and 680,000 tons for building construction. The quantity produced for road projects was nearly 1.2 million tons more than in 1961. The largest single contract was $8.4 million for a freeway south of Bakersfield involving 13.3 miles of base course and concrete paving, including 10 concrete overcrossings. Substantial

quantities of stone were quarried and crushed for riprap and road base. The rise in limestone and sandstone tonnages quarried for use in making cement reflected the overall increase in stone output over 1961. Sandstone, quartz, and miscellaneous stone were quarried near Mojave, Rosamond, and Lake Isabella for use as dimension building stone and rubble and crushed for sale as roofing granules and exposed aggregate. Producers mined 855,000 tons of gypsum near Lost Hills, Maricopa, and Taft, principally for agricultural use. The State's major producer of agricultural gypsum, H. M. Holloway, used mobile loading, crushing, and screening equipment to work the Lost Hills deposit. Company crews removed a substantial volume of overburden to stay well in advance of the self-propelled mining and processing operation. Western Salt Co. harvested solar-evaporated crude salt from Koehn dry lake and processed it in its Saltdale plant. The plant product was shipped to customers in Los Angeles County, chiefly for use in preparing animal feeds. Clays were dug near Tehachapi for use in making cement at Monolith. Clays used in compounding drilling muds were mined by Macco Corp. near Rosamond, by McKittrick Mud Co. near McKittrick, and by Mojave Corp. near Boron. In the McKittrick area, Excel Minerals Co. mined clays used as absorbents. American Minerals Co. mined clays near Mojave that were sold for use in pottery and stoneware. Macco Corp. also prepared barite from its Tulare County mine in its Rosamond plant for use in well drilling muds, glass, and paint. Calsilco Corp. mined and prepared pumice near Saltdale for abrasive, absorbent, and filler uses.

Sierra Quicksilver Corp. retorted ore from its mine near Keene and recovered about 50 flasks of mercury. Tungsten ore was mined and milled at the Hill Top mine near Isabella. The tungsten concentrate was shipped to a plant in Nevada where it was used in making tungsten carbide.

Eight lode gold properties were active for part of 1962. The Yellow Aster, Florence (North Star), Police Dog, and Big Dyke mines in the Randsburg area yielded ores from which gold and silver were recovered by amalgamation. Old tailings at the Butte Lode mine, in the same area, were treated by cyanidation to recover gold and silver. Ore from the Wegmann Group (Silver Vein lease) in the Mojave area was shipped to a smelter at Miami, Ariz. A few tons of gold ore from the Whitmore property was treated by amalgamation to recover gold and silver. Gold and silver also were recovered by amalgamation from gold ores mined at the Jack Pot mine and Porter group of claims, Clear Creek area. Stream gravels in the Randsburg area and on the Kern River were worked to recover placer gold and silver. A sluicebox was used in conjunction with the Griffith Co. sand and gravel preparation plant on the Kern River, near Bakersfield, and placer gold and silver recovered.

Kings.—The Kettleman North and Middle Dome fields and the Pyramid Hills group supplied the county's entire crude oil production. Output was 13 percent less than in 1961. The decrease was attributed to normal field declines coupled with the fact that no new fields or pools were discovered. One exploratory well was drilled in the extreme northern part of the county and reached basement. A 30-percent decline in yield of natural gas from oil zones also was re-

ported. Natural dry gas production, from the Dudley Ridge field and part of the Trico field, also declined 30 percent. Five plants extracted natural gas liquids from wet gas. Caminol Co. added facilities at its Hartford refinery that increased the plant's crude oil capacity from 7,500 to 10,000 barrels per day.

A substantial tonnage of sand and gravel was produced for road and other construction projects, chiefly at and near the Lemoore Naval Air Station. Prepared sand and gravel and crushed stone for concrete aggregate used in paving and building construction were supplied principally by producers in Fresno and Tulare Counties. Agricultural gypsum was mined from the McPhail Gypsum Co. deposits near Avenal. Ore from the Dawson mine in the Parkfield area was retorted to recover mercury. The nearby Little King mercury property was idle throughout 1962.

Lake.—As a result of smaller State highway projects, including those near Cobb and Lucerne, less sand and gravel was produced in plants in the Clearlake Highlands, Lakeport, and Middletown areas than in 1961. More aggregate material was used in county road work than for State highway contracts. The demand for concrete aggregate in building construction rose from 52,000 tons in 1961 to 67,000 tons, but stone quarried for riprap and road base dropped to 8,000 tons from 11,000 tons. Cinder Products Co. mined scoria (volcanic cinder) near Clearlake Oaks and sold it for use in landscaping and as roofing granules. Volcanic ash used for fill was produced near Clearlake Highlands. Sulfur ore was mined on the S Bar S ranch east of Kelseyville by American Mineral Resources Development Co. and sold as a soil additive.

Mine dump material was retorted at the Abbott mercury mine. On the Baker property dump material was upgraded by jigging and tabling and then furnaced to recover mercury.

Lassen.—Sand and gravel and stone were produced by maintenance crews of the Lassen County road agency, the Sierra Ordnance Depot, and State highway contractors. The materials were used for road base and surface aggregate. Highway projects near Johnstonville and Thermo required appreciable quantities of gravel in 1962. Crews and contractors for the California Division of Highways mined volcanic cinder at various locations and used the material in the maintenance and repair of roads. Mt. Lassen Cinder Co. worked the Poison Lake cinder deposit for material used for concrete aggregate.

Los Angeles.—Crude oil production rose 7 percent above that of 1961 to 74,386,315 barrels, and gas output from oil zones was up 1 percent to 80,318 million cubic feet. The petroleum increase was attributed largely to the numerous active secondary recovery projects, particularly in the Dominguez and Wilmington fields. About 48 percent of all the water injected in the State went into the Wilmington field. Forty-one exploratory wells were drilled in the county during 1962, seven of which were successful, resulting in two discoveries. Texaco, Inc., discovered a new field, the Tapia (Wayside Canyon area), and Herbell Oil Exploration Co. opened a new pool, the McGrath (Recreation Park area of the Seal Beach field). Fifty-two dry holes were drilled, 17 more than in 1961. Of these, 34 were exploratory and 18 developmental. Los Angeles County remained the State's refining

center, with nearly 65 percent of the total refining capacity. Shell Oil Co. added 5,000 barrels a day to the capacity of its Wilmington refinery, Douglas Oil Co. of Calif. increased capacity at its Paramount refinery by 1,250 barrels a day, and Golden Eagle Refining Co., Inc. added 500 barrels a day to its Torrance refining capacity. Nineteen plants were operated for the extraction of natural gas liquids from wet gas. Production of these products followed the 1962 decline of natural gas output from oil zones. The yield in natural dry gas rose 26 percent above the 1961 figure, to 2,255 million cubic feet. Most of the output came from the El Segundo field where four wells were completed in 1961. At yearend 1962, the field had 12 producing wells.

Nearly 8 million tons of paving sand and gravel was produced at commercial preparation plants and by contractors for road base and concrete aggregate used in construction of streets, highways, and interchanges, 1 million tons less than in 1961. The decline in requirements for sand and gravel in road projects was offset by the increased demand for these materials in building construction. Eleven commercial sand and gravel plants in the Arcadia, Azusa, Irwindale, Pasadena, and Sun Valley areas each produced more than 1 million tons for a total of 19.2 million tons. Six of 17 other commercial plants in the county produced between 500,000 and 1 million tons each. Lesser tonnages of sand and gravel were produced by public works crews and contractors for road maintenance and repair. Producers of industrial sands operated pits near El Segundo, Huntington Park, and Torrance and prepared the material for blast, molding, foundry, and other industrial uses. Activity at the Pebble Beach and Empire quarries on Santa Catalina Island was the chief reason for a rise in the 1962 stone output. Dike and revetment rock was quarried on the island for use in the Long Beach and Los Angeles harbor areas. Stone quarries at Palos Verdes and Saugus were principal sources of dimension building stone and flagging. Substantially larger tonnages of granite and decomposed granite were obtained at various locations and used for riprap and base course in construction work.

Crude gypsum from a company mine in Nevada was calcined by Fibreboard Paper Products Corp. at South Gate for use in lath, plaster, and wallboard. Kaiser Gypsum Co. imported the mineral from Mexico for its Long Beach plant. Clays were mined at pits in the Torrance, Compton, and Van Nuys areas for use in making heavy clay products. A comparatively small tonnage of clays mined in the San Fernando area was sold for use as a carrier in insecticides and fungicides. Stockpiled soapstone, previously mined from the Katz property in Sierra Pelona Valley, was shipped to a Los Angeles grinder. Six plants ground talc, soapstone, or pyrophyllite received from California and Nevada mines. Seven companies in the Los Angeles area expanded crude perlite obtained from producers in California, Nevada, Arizona, and New Mexico. Calada Minerals Co. ground crude barite in its Harbor City plant. The barite was mined in Nevada and prepared for use in well drilling muds. California Zonolite Co. exfoliated crude vermiculite from its Montana mine and sold the product for lightweight aggregate, insulation, and soil additive. Scrap mica received from Colorado and South Dakota and im-

ported from India, was dry ground in a Los Nietos plant by Sunshine Mica Co. for use in paint and roofing materials.

Waste oil-well brines were pumped from wells in the Los Angeles Basin to an iodine recovery plant in Orange County. U.S. Borax & Chemical Co. operated its Wilmington refinery on crude and partly refined borates produced by the company in Kern County. Some sodium sulfate was produced as a byproduct in the borate refinery.

San Gabriel Valley Placers operated sluiceboxes in conjunction with the Azusa Gravel preparation plant and recovered placer gold and silver. Individuals panned stream gravels in the San Gabriel River channel and obtained small quantities of placer gold. Three steel companies operated electric furnaces and one used open hearth furnaces in the Los Angeles area to produce steel ingots from ferrous scrap. All four companies also produced finished steel products for sale.

Madera.—Natural dry gas production declined 20 percent from that of 1961, to 2,040 million cubic feet. The largest volume decline was reported at the Gill Ranch field, while the greatest drop percentagewise was in the Chowchilla field. Three new wells were completed in the latter field.

Sand and gravel production at plants along the Fresno, Chowchilla, and San Joaquin Rivers and by Government contractors in other locations was less than in 1961 because of fewer road construction and land reclamation projects. Sand and gravel produced for concrete aggregate used in building construction was 10 percent under the 1961 figure. Dimension architectural and monumental stone was obtained from a granite quarry near Raymond. Stone quarries near O'Neal and Oakhurst were sources for stone used in building construction. Several thousand tons of granite and miscellaneous stone was quarried by public works crews and contractors for riprap and road base. California Industrial Minerals Co. worked the Taylor cinder deposit near Belleview for volcanic ash that was prepared for use as a carrier in pesticides. U.S. Pozzolan Corp. mined pumice from its Erickson property in the same area, for lightweight aggregate. Hans Sumpf Co. worked its clay deposit near Madera to obtain material that was molded and stabilized with emulsified asphalt and used in making adobe brick.

New Idria Mining & Chemical Co. operated its Strawberry tungsten mine and mill near Bass Lake from June through October. The tungsten concentrate produced was shipped to an Inyo County chemical plant or stockpiled at the producer's Fresno chemical plant, construction of which was completed in December.

Marin.—A substantial tonnage of sand was dredged from the Bay near Sausalito for use as fill. Streambed deposits of sand and gravel in the Point Reyes and other areas were sources for aggregate produced for paving and building at commercial and Government projects. Basalt quarried at Novato and sandstone quarried at the McNear and Greenbrae deposits were prepared for use as riprap, road base, and concrete aggregate. Government contractors at Fort Barry and the Muir Woods National Monument quarried small tonnages of stone for embankment use. Shale was quarried at San Pedro Hill west of San Rafael and used by L. P. McNear Co. in making brick and by

McNear Co. to produce lightweight (Haydite) aggregate. Scottlite Products (Pacific Panel Associates) expanded crude perlite received from an Inyo County mine in a plant at Sausalito. The Chileno Valley (Edwards) mercury mine, near Marshall, was active. Ore from the mine was retorted to recover a substantial quantity of mercury.

Mariposa.—Sand and gravel was produced from streambed deposits or old tailings in the Mariposa, El Portal, and Buck Meadows areas and used for concrete aggregate and road base. Some aggregate was produced by Government crews for use in maintaining county, State, and National Park roads. Sand and gravel production was higher than in 1961 for building construction and paving projects. Three stone quarries in the Coulterville area were worked for dimension building stone and roofing granules. Flagging and roofing slate were produced at two quarries near Mariposa.

Eight lode gold mines reported activity during part of 1962. Ore from the Red Banks mine near Kittridge yielded most of the gold and silver produced. Copper ore mined at the Copper Queen property near Mt. Bullion was shipped to the Selby smelter, Contra Costa County. The ore contained recoverable gold, silver, and copper. Mariposa Sand & Gravel Co. recovered byproduct placer gold and silver in its nonfloat washing plant near Mormon Bar. Stream and bench gravels were panned for gold and silver near Coulterville.

Mendocino.—Production of sand and gravel for building construction and for freeway projects near Ukiah, was appreciably higher than in 1961. Preparation plants were operated near Ukiah, Fort Bragg, and Willits by crews and contractors for public works agencies. Nearly 89 percent of the total output was prepared, either in stationary or portable plants. The other 11 percent was used as pit-run material. Stone was quarried by contractors for the U.S. Army Corps of Engineers and by State and county road crews for riprap, road base, and surface aggregate. High-grade mercury ore was mined at the Janusz "B" prospect near Hopland and retorted to recover the metal.

Merced.—Sand and gravel production at plants near Atwater, Cressey, LeGrand, Los Banos, Merced, and Snelling for use in building and road construction was lower than in 1961. Much of the material required for roads was produced and prepared by county road crews and Bureau of Reclamation contractors. Basalt and miscellaneous stone were quarried by contractors for the California Department of Water Resources and by the Bureau of Reclamation for riprap and aggregate required in irrigation projects and for preliminary work at the site of the proposed San Luis Dam. Gypsum was produced by Agricultural Minerals & Fertilizer Co. at the Little Panoche and Ortigalita deposits near Los Banos. Baroid Division, National Lead Co., processed crude barite from its Nevada mine in the producer's Merced plant. The plant product was used and sold for use in compounding well drilling muds. Sluicing methods were used to recover byproduct placer gold and silver at the River Rock, Inc., sand and gravel dredging and washing operation on the Merced River near Snelling. A few prospectors in the same area recovered the metals by planning stream gravels.

Modoc.—Sand and gravel was produced at a commercial plant in Alturas and by Government crews and contractors. County crews produced and prepared large tonnages of gravel for road maintenance and repair. Contractors for the City of Alturas prepared sand and gravel for the city street department. Basalt and miscellaneous stone were quarried for riprap and road base by contractors for the State highway agency and the Bureau of Reclamation. The California Division of Highways contracted for volcanic cinder which was obtained from various deposits, for road maintenance and repair. The Herman Free pumice property in the Tionesta area was a source of lightweight aggregate. A dragline excavator was used by American-Modoc, Inc., to mine peat moss from a bog in Jess Valley near Likely. The material was dried and shredded for sale as a soil-improvement agent. Most of the product was packaged, and shipments of the peat were made to customers in California and neighboring States.

Mono.—Pumice was mined in the Lee Vining area by U.S. Pumice Supply Co., Inc., and prepared for abrasive uses. Featherock, Inc., prepared the material for landscaping and decorative uses. Bishop Building Materials mined pumice from the Cowan property, near Benton, for use as lightweight concrete aggregate. Pumice from another deposit, southwest of Benton, was used for plaster aggregate. Callahan Industrial Minerals Co. mined kaolin from the Little Antelope deposit in the Casa Diablo area and pyrophyllite near White Mountain. The kaolin was prepared for use in cement and for filler applications; the pyrophyllite was ground in the Laws (Inyo County) plant for use in pesticides and paint. At yearend all Callahan holdings, property, and equipment reverted to the former owner, Huntley Industrial Minerals Co., when Callahan failed to exercise its option to purchase. Sand and gravel was produced by county crews for road maintenance, and by State and Federal contractors for construction of roads and structures near June Lake, Mammoth Lakes, and Sonora Junction. Tungsten concentrate produced at the Nichols mine in the Red Mountain area was sold to Union Carbide Nuclear Co., Inyo County. Ore from the Sierra Washington property in the Mammoth Lakes area was smelted in Contra Costa County to recover gold and silver.

Monterey.—Crude oil production was 11,230,352 barrels, down 5 percent from 1961. Virtually the entire output was from the San Ardo field whose two pools, the Lombardi and Aurignac, reached peak production in 1960 and 1954, respectively. The drop in production was attributed to a normal decline. An in situ combustion project was in operation at San Ardo in 1962, and a hot water-injection project was active in the Parris Valley field. Moriqui Exploration Co. had a new field discovery with a well completion northeast of San Ardo. The new field (Lynch Canyon), like others in the county, yielded low-gravity crude oil. There was one unsuccessful exploratory well at San Ardo that reached basement.

Road construction, including major highway projects north of Gonzales and south of San Ardo, required more sand and gravel than in 1961, but demand for these materials in building construction was slightly lower. Virtually all the sand output came from beach dune deposits near Seaside, Marina, and Castroville; gravel was obtained

chiefly from streambed deposits of the Carmel and Salinas Rivers. Industrial sands for blast, filtration, and other uses were prepared in plants between Seaside and Castroville. Owens-Illinois Glass Co. and Del Monte Properties Co. were major producers of glass sand. The latter also produced silica and feldspar concentrates, some of which were blended and/or ground to customer specifications. The specialty products were sold to ceramic and pottery plants or used for foundry and filter purposes.

Kaiser Aluminum & Chemical Corp. quarried dolomite at Natividad for calcining, roofing and landscape rock, industrial fillers, and other uses. A heavy-medium process was used to prepare raw dolomite for calcining. The company operated kilns and a hydrator to produce dolomitic lime, mainly for its Moss Landing magnesia plant, although some was sold for construction, agricultural, and other uses. Dead-burned dolomite was produced for use as flux at metallurgical plants, and for making refractory brick. Some magnesium hydroxide recovered in the company's sea-water-processing plant was sold, but most of the product was consumed by the producer in making refractories.

Monterey Bay Salt Works harvested crude salt from about 400 acres of solar evaporating ponds near Moss Landing. The crude product was used by ice companies, water-softening plants, and other local industries. Spreckles Sugar Co. near Salinas kilned purchased limestone to obtain carbon dioxide gas and lime used by the company in processing sugar beets. Decomposed granite, obtained principally from a pit near Pebble Beach, was used for road base and fill in various private and public works construction projects.

Napa.—Basalt Rock Co. mined shale near Oakville and expanded the material for lightweight aggregate in its Napa plant. Another plant product was pozzolan for cement, prepared from diatomaceous silica mined by the company. Basalt Rock also worked the Pedrotti quarry near Napa for rhyolite used for riprap, concrete aggregate, and road-base material. The Parker Hill quarry was a source for riprap and roadstone produced by Napa County road crews.

Leslie Salt Co. harvested its first crop of crude salt (harvesting began late in 1961) from solar exaporating ponds along San Pablo Bay. Asbestos Bonding Co. produced several grades of filler materials from ore processed in its Phoenix plant near Napa. Perlite Aggregates, Inc., operated an expanding plant near St. Helena using crude perlite obtained from its nearby Alvo mine.

Ore from the Aetna mine near Aetna Springs was retorted to produce several flasks of mercury. Five operators retorted dump material from the Oat Hill mine to recover mercury or worked the James Creek gravels to recover mercury that had washed into the creek bottom from the old Oat Hill operation. Dump material at the Knoxville mine, near Knoxville, was upgraded before retorting for mercury recovery.

Nevada.—Sand and gravel for structural and paving uses was produced and prepared at plants near Truckee and Grass Valley and by crews and contractors for State and county road agencies. Substantial quantities of sand and gravel were required for highway construction east of Soda Springs near Castle Peak, and near Donner Lake. Stone was quarried and crushed by contractors for the State highway agency

and for the Bureau of Reclamation for road-base material and riprap used in embankments.

At Grass Valley, cleanup operations around the Brunswick-Idaho Maryland workings, and treatment of dump material and old tailings at the Empire Star Group, yielded most of the lode gold and silver output and some recoverable zinc. Gold was recovered from ore specimens at the Queen property, and from cleanup material at the Red Ledge mine in the Washington area. Gold ore from the Indiana mine south of Grass Valley was concentrated before shipment to the Selby smelter, Costra Costa County, for recovery of gold and silver. Two dragline and one nonfloat washing plant worked ancient riverbed gravels in the French Corral area to recover placer gold and silver. A drift mine in the Bear Valley area recovered some placer gold from ancient riverbed gravels. Stream gravels were panned in the French Corral, Grass Valley-Nevada City, Washington, North Columbia, and Bear Valley areas, and small quantities of placer gold and silver were recovered.

Orange.—Crude oil production was about 3 percent below that of 1961, yet the natural gas output from oil zones rose over 6 percent. Huntington Beach field was the State's largest producing field, yielding 42,458 barrels a day from 1,650 wells. Nine dry holes were drilled in the county; one was exploratory, the others developmental. The attempts to increase petroleum production were directed toward secondary recovery projects rather than development drilling. A pattern water-injection project and a gas-sweep operation were in progress in the Richfield field. At Yorba Linda, a steam-injection project was in operation. Six processing plants were operated to extract natural gas liquids from natural wet gas. Plant output for all products was below 1961 figures. The only oil refinery in the county was the Socal Oil & Refining Co.'s 5,000-barrel-a-day Huntington Beach thermal cracking plant.

Sand and gravel production was 2 million tons above that in 1961. Paving projects used 3.6 million tons and building construction required 4.5 million tons. Much of the remaining output was used for fill. State highway projects used about 2 million tons for road base and concrete aggregate. Preparation plants that produced more than 500,000 tons each were operated near Anaheim, Orange, El Modena, Santa Ana, and San Juan Capistrano; three of these produced more than 1 million tons each. Industrial sands were produced in the Trabuco Canyon and El Toro areas for cement, refractory, and ceramic uses. Decomposed granite and miscellaneous stone were quarried for road base and riprap by contractors at paving and flood control project sites. A clay-sand mixture was mined by California Nonmetallics in the Trabuco Canyon area and by W. A. Schoeppe Clay Co. near El Toro. Both companies sold some of the material for foundry ganister and prepared washed kaolin and sand. Crestlite Aggregates Co. mined and expanded shale near San Clemente for use as lightweight aggregate. Clays were dug near Huntington Beach by La-Bolsa Tile Co. and near Tustin by Pacific Clay Products Co. and used in making heavy clay products. Holly Sugar Co. burned purchased limestone at Dyer to obtain carbon dioxide gas and lime used in processing sugar beets. Western Salt Co. harvested crude salt from

six solar evaporating ponds of Newport Bay Salt Works at Corona Del Mar. The product was sold in bulk and bags to local consumers, and some salt works bittern was marketed as a herbicide. Dow Chemical Co. operated an iodine-extraction plant at Seal Beach on waste oil-well brines pumped from wells in the Los Angeles basin. The company announced it would transfer all crude iodine production to Midland, Mich., by September 1964 for economic reasons.

Lahabralite Co. exfoliated crude vermiculite imported from Transvaal, South Africa, in an Anaheim plant. The product was sold for insulation and as aggregate in plaster and concrete. Unprepared peat humus was mined from the R. W. McClellan & Sons pit near Huntington Beach and mixed with earth for sale as top soil.

Placer.—Sand and gravel was produced at commercial plants and by Government contractors from stream gravels along the Bear River near Auburn and Colfax and from Blackwood Creek near Tahoe Pines. The combined output for paving and building construction was considerably below that of 1961. Blast sand, landscaping gravel, and concrete aggregate were prepared in the Joe Chevreaux plant on Bear River near Lake Combe. A cleansing powder was produced from Bear River sand by Sierra Nevada Milling Corp. in a plant south of Colfax. Rough construction stone and dressed architectural and monumental stone were produced at a granite quarry near Rocklin by Union Granite Co. The company also prepared poultry grit and roofing granules for sale. Decomposed granite was quarried near Auburn and used for road base and fill. International Pipe & Ceramics Corp. (Gladding, McBean & Co.) and Lincoln Clay Products Co., Inc., mined fire clay in the Lincoln area for use in making brick, structural tile, and sewer pipe.

A small tonnage of gold ore was shipped from the Ford group of claims, near Foresthill, to the Selby smelter in Contra Costa County. The ore contained recoverable gold and silver. Two suction dredges near Colfax and Foresthill recovered small quantities of placer gold and silver from stream gravels. Prospectors worked stream gravels by smallscale hand methods at widely scattered locations in the county to recover placer gold and silver.

Plumas.—Commercial preparation plants near Quincy and Portola produced sand and gravel. The materials were also produced by State and county road agencies and the California Department of Water Resources. The combined output was more than 200,000 tons, a lower tonnage than in 1961 due to completion of major road and water-conservation projects. The quantities of stone quarried for riprap and road base in public works projects also were substantially lower. The Tobin quarry, near Tobin, supplied riprap used by maintenance crews of the Western Pacific Railroad Co. W. T. Sligar worked the Cameron barite deposit (a new producer) near Canyondam and shipped the mineral to grinders in Sacramento and Sutter Counties.

Copper ore was shipped from the Engels mine near Greenville to a smelter at Tacoma, Wash., for recovery of copper, gold, and silver. Gold ore from the Golden Mary prospect south of Bucks Lake was treated by amalgamation to recover a small quantity of gold. A sluice-box was used to recover gold and silver from some old placer tailings

near LaPorte. Individuals panned stream gravels at various locations in the county to recover placer gold and silver.

Riverside.—The Eagle Mountain iron mine was operated by Kaiser Steel Corp. throughout 1962, but mine output was down 25 percent. Direct shipping grade ore was mined for the first time since 1959. Most of the mine-run ore was upgraded in the nearby concentrator before shipment to the company steel plant at Fontana, San Bernardino County. Production and shipments of concentrate dropped 32 and 35 percent, respectively. Exports rose 35 percent as the Kaiser Steel Corp. 10-year contract with Mitsubishi Shoji, Ltd., negotiated a year earlier, became effective. At the Storm-Jade open-pit and underground iron prospect in the Joshua Tree National Monument area, exploration and development work produced a few tons of iron ore, but no shipments were made.

Riverside Cement Co. produced grey and white cements in its Crestmore plant and made shipments by truck and rail to customers in California, Nevada, Arizona, Utah, and other western States. Larger quantities of white cement went to customers who formerly purchased the material from out-of-State sources. A ball mill, dust collectors, and storage silos were installed as the first phase of an $18 million building program at the Crestmore grey cement facility. New finish grinding equipment was scheduled for 1963, and replacement of old kilns was expected by the end of 1964. Nearly 2 million tons of sand and gravel for building and paving was produced at plants near Mira Loma, Banning, Desert Hot Springs, Cathedral City, Indio, San Jacinto, and Blythe. Government crews and contractors produced some of the sand and gravel. Near Corona, glass sand was produced by Owens-Illinois and silica sand for use in making white cement by Riverside Cement Co. Limestone was quarried at Crestmore for use in cement and at Nightingale by H. T. Lucas Mining Co. for roofing granules. About 765,000 tons of granite and decomposed granite was quarried in the Riverside-Corona area for riprap, road base, fill, and poultry grit. Over 250,000 tons of granite was quarried by contractors for public works harbor and flood control projects. Minnesota Mining & Manufacturing Co. operated a stone quarry in Temescal Canyon and produced roofing granules which were artificially colored in a nearby plant.

Clay deposits in the Elsinore, Alberhill, and Corona areas were sources for fire clay and miscellaneous clay used in cement and in heavy clay products, refractories, stoneware, pottery, and draintile. The major producers were Corona Clay Co., International Pipe & Ceramics Corp., Riverside Cement Co., and Liston Brick & Clay Co. Pacific Clay Products Co. was conducting extensive exploratory drilling in the Alberhill area. Gypsum mined near Midland by U.S. Gypsum Co. was used in making lath, wallboard, and plaster, and sold for agricultural purposes. During the year the company replaced some of the mobile equipment at the mine and added a new kettle to its calcining unit. A part of the Midland underground mining property was leased to the county's civil defense agency as a public fallout shelter. The Midland area was also a source for float wollastonite collected and sold for decorative uses.

Reed-sedge peat was dug from a deposit near Banning. The material was air-dried and shredded for bulk shipment to customers as a soil improvement agent. Crude oil production dropped 26 percent below 1961 output, all of which came from the Prado Dam field, the county's only oilfield.

Sacramento.—Nearly one-fourth of the State's natural dry gas production came from wells in Sacramento County. The reported volume output was 9 percent below that in 1961. The Rio Vista field, the State's largest gasfield, lies partly within the county. Declines were reported for the Rio Vista (both the Main and Isleton areas), Thornton, and Freeport fields, while the West Thornton and Walnut Grove fields registered increased outputs. During 1962, seven new wells were completed to production in the West Thornton-Walnut Grove area, five at Rio Vista, and one at Freeport. Fifteen dry holes were drilled, seven more than in 1961. Two new gas discoveries were reported, a new pool by McCulloch Oil Corp., of California in the Freeport field and a new field (Poppy Ridge) by Milton L. Johnston in the westcentral part of the county.

Sand and gravel production dropped over 1 million tons from that of 1961, due chiefly to the 2-month-long northern California construction strike. The output was down about 800,000 tons for paving projects and nearly 300,000 tons for building construction. The major sand and gravel preparation plants were near Sacramento, Fair Oaks, Del Paso, and Perkins. Commercial producers at these and other locations supplied over 4 million tons, the remainder was produced by Government crews and contractors. Industrial Minerals & Chemicals Co. and R. J. Robideaux mined fire clays near Ione; miscellaneous clay was produced for heavy clay products by Cannon Co. at Michigan Bar and by Sacramento Brick Co. in the Sacramento area. Industrial Minerals ground barite from Plumas County and Nevada for its own use and custom-ground clays and limestone to customer specifications. California Zonolite Co. exfoliated crude vermiculite from its Montana mine in a company plant at Sacramento. The plant product was sold for insulation (thermal and acoustical), lightweight aggregate (plaster and concrete), and as a soil additive.

The Natomas Co. operated a bucketline dredge on the American River near Folsom until February 12, at which time the company discontinued all dredging operations in the county. Gold and silver were recovered and shipped to the San Francisco Mint. Four sand and gravel preparation plants on the American River in the Folsom area recovered byproduct placer gold and silver. Stream gravels were panned in the same area by individuals to recover these metals.

San Benito.—Six mercury properties were active but only one, the New Idria, yielded more than a few flasks of mercury. The New Idria mine was the Nation's major mercury producer. About midyear New Idria Mining & Chemical Co. reported the discovery of a new ore body that was expected to increase ore reserves and metal output substantially. The company's production was about 4 percent above that of 1961. Relatively small volumes of crude oil and natural gas (both wet and dry) were produced, as all three commodities recorded large declines from those in 1961. Output of petroleum was down 40 percent; natural wet gas, 51 percent; and dry gas, 36 percent.

One dry hole was drilled and a peripheral waterflood project at Vallecitos was suspended in June after being in operation a year.

Portland cement was produced at San Juan Bautista by Ideal Cement Co. The company produced clinker in its wet process plants using limestone from a nearby quarry and shale from Santa Cruz County. FMC Corp. quarried limestone near Hollister and shipped it to its magnesia plant at Newark, Alameda County. At Logan, Granite Rock Co. operated the State's largest granite quarry to supply customers with riprap and aggregate. Sand and gravel was produced at plants along the San Benito River near Hollister, and by county maintenance crews. Compared with 1961, the output was lower, because of a labor strike in the construction industry. Fresno Agricultural Chemical Co. (subsidiary of Wilbur-Ellis Co.) prepared bentonite from the Lewis pit near Idria as a waterproofing material in reservoirs, a carrier in pesticides, for foundry facing powder, and other industrial uses. The company also custom-ground borate minerals and barite to customer specifications.

San Bernardino.—Portland cement was produced at Colton by California Portland Cement Co., at Oro Grande by Riverside Cement Co., at Victorville by Southwestern Portland Cement Co., and at Cushenbury by Permanente Cement Co. The plants had a combined capacity of 19.3 million barrels of cement in 1962, produced 15.8 million barrels, and shipped 14.7 million barrels. Bulk and bagged shipments were made by truck and rail to customers in California, Nevada, Arizona, and Utah. Major improvement and modernization programs were in progress at two plants. At the Colton plant, kilns, ball and finishing mills, storage silos, and loading facilities were being installed under a rebuilding project. At Cushenbury, the largest cement kiln (520 feet long) in the West, and the world's largest cement grinding mill (41 feet long by 13 feet in diameter), were being added to increase plant capacity to 5.4 million barrels annually.

Sodium borates, boric acid, potassium chloride and sulfate, sodium carbonate and sulfate, crude dilithium-sodium phosphate, and elemental bromine were extracted from the natural brines of Searles Lake by American Potash & Chemical Corp. in its Trona plant. West End Chemical Co. Division, Stauffer Chemical Co., operated a plant on the south side of the playa and extracted sodium borate, carbonate, and sulfate (including glauber salt) by a different process. Most of the elemental bromine and potassium salts produced by American Potash was sold to chemical and fertilizer plants in Los Angeles. The State's entire output of calcium chloride was produced from brines of Bristol Lake by California Salt Co. and National Chloride Co. Both companies recovered the compound as crude liquid. Some of the output was sold to Hill Bros. Chemical Co., which produced a flake product in a nearby plant. Products from all three plants were marketed in southern California, Nevada, and Arizona as fireproofing and hygroscopic agents. Crude salt was harvested through solar evaporation from Bristol Lake brines by California Salt Co. and from brines of Danby and Searles Lakes by Pacific Salt Co. California Salt also mined halite (rock salt) from an open pit for sale principally in making chlorine gas. The Metropolitan Water District of

Southern California used solar evaporated salt from Danby Lake brines as a water softening agent.

Nearly 6.4 million tons of sand and gravel was produced, about 250,000 tons more than in 1961. The tonnages of aggregate required for building and paving projects were high, but the demand for these materials for fill was lower than in 1961. Appreciable quantities of sand and gravel were used in freeway construction projects, chiefly Interstate Highway 15 near Barstow, Yermo, and the Nevada line. County crews produced about 227,000 tons of sand and gravel for road maintenance. Over 4.8 million tons of limestone was quarried in the Lucerne Valley, Victorville, Colton, and Oro Grande areas for use in making cement, lime, glass, roofing granules, and industrial fillers. Dimension granite was quarried near Wrightwood and in the Joshua Tree National Monument area. Decomposed granite was mined for fill and road-base material. Marble was quarried near Yucca Valley and Victorville for building stone and terrazzo. Sandstone, quartz, and quartzite were quarried near Baldwin Lake, Big Bear Lake, Twentynine Palms and Oro Grande for building construction stone, cement, rock wool, and fillers. Miscellaneous stone was quarried in the Barstow area and prepared for sale as roofing granules and landscaping rock.

Iron ore from the Iron Age open-pit mine south of Danby Lake was upgraded to yield open hearth lump ore for domestic steel furnaces. A lower grade material was sold to cement plants. Kaiser Steel Corp. worked its Silver Lake iron property northwest of Baker for 4½ months during the summer. A little more than half the output was shipped to Fontana; the remainder was stockpiled at the railroad siding. Copper ore mined at the Big Scotty property in the Whipple Mountains was shipped to a smelter at Hayden, Ariz. Gold ore mined in 1961 at the Rose prospect south of Dobie was hauled to the smelter at Miami, Ariz. Prospectors in the Twentynine Palms area recovered placer gold and silver by panning stream gravels. Bastnaesite ore was mined and milled at the Mountain Pass property of Molybdenum Corporation of America. Production and shipments of rare-earth concentrates were appreciably above the 1961 figures.

Much of the State's talc production came from 12 deposits in the county, chiefly the Silver Lake-Yucca Grove area. The major producers were Southern California Minerals Co., Western Talc Co., and Sierra Talc Co. In all instances the crude talc was shipped to Los Angeles grinding plants. Mineral Materials Co. mined pyrophyllite from its Victorite property northeast of Victorville. Some of the material was shipped to grinders, but most of the output was stockpiled. Anchor Minerals Division, C. K. Williams Co. (formerly Victorville Lime Rock Co.) at Lucerne Valley, and California Portland Cement Co. at Colton each operated a lime kiln to provide lime for industrial purposes. The Colton kiln was shut down in April. West End Chemical Co. operated a kiln and hydrator at Searles Lake to provide carbon dioxide for its own use and lime for agricultural, chemical, and other industrial uses. Southern California Minerals Co. and International Pipe & Ceramics Corp. mined ball clay from the Hart deposit near Ivanpah and sold or used the material for making wall and floor tile. Brown Minerals Co. sold bentonite from the

Honey Brown property near Vidal to companies making animal feeds. Inerto Co. mined hectorite at its Geyser View claims near Newberry for use in beverage clarification. Hectorite mined by Baroid Division, National Lead Co., from the Hector mine near Daggett was shipped to company processing and refining facilities in Houston, Tex. Miscellaneous clay was mined for use in making cement and heavy clay products near Lucerne by Permanente Cement Co., near Oro Grande by Riverside Cement Co., near Chino by Shale-Lite Corp. and Pomona Brick Co., and near Highgrove by Hancock Brick Co. Volcanic cinder was obtained in the Cima area for concrete aggregate by Aiken Builders Products and Cima Cinders. The Williams pumice property, near Opal Mountain, was worked for volcanic ash used in soil conditioning.

Although relatively small quantities of crude oil and natural wet gas were produced from the Chino-Soquel field, the outputs rose 7 and 16 percent, respectively, above 1961 figures. Production was confined to a small area in the extreme southwest part of the county. Two dry holes were drilled in the area and abandoned.

San Diego.—Sand and gravel production dropped 140,000 tons from that in 1961, chiefly as a result of reduced construction of residential subdivisions. An increased demand was reported for paving aggregate, used in major projects in San Diego and near Vista and Carlsbad. About 4 million tons of sand and gravel was produced and prepared at stationary and portable plants operated by commercial producers and Government crews and contractors. The major preparation plants were in the San Diego area, but appreciable quantities of sand and gravel came from deposits near Poway, Rancho Santa Fe, Oceanside, Vista, Escondido, and Borrego Springs. A greater tonnage of industrial sands was produced in the Oceanside area than in 1961 and was consumed in plaster, glass, and other industrial uses. Granite was quarried near Escondido for architectural and monumental use. Decomposed granite from various deposits was sold for road base and fill. Basalt, sandstone, and miscellaneous stone were quarried for riprap, building construction, roofing granules, and many other uses.

Western Salt Co. harvested crude salt produced by solar evaporation of sea water in its South Bay ponds. The crude salt was processed in the company's Chula Vista plant and sold locally for a wide variety of industrial uses. Western Salt also pumped saltworks bitterns to the nearby FMC Corp. plant, where the latter extracted magnesium chloride. The city of San Diego removed lime from its domestic water (Colorado River) supply and used the material in its Alvarado and Miramar water-treatment plants. Pyrophyllite was produced in the San Diequito area by H. G. Golem, who shipped from his Four-Gee mine to a Los Angeles chemical company, and by Harborlite Corp. from the Harris mine and Organic Mineral Sales, Ltd., from the Pioneer mine, which shipped to their own grinding plants in San Diego. At Escondido, Harborlite expanded crude perlite received from a Nevada producer. Hazard Bloc Co. and Union Brick Co. mined miscellaneous clay near San Diego for making heavy clay products. The Rose Quartz mine near Pine Valley yielded a few ounces of gold and silver by amalgamation. Individuals panned stream gravels for placer gold and silver at various localities.

San Francisco.—Red rock was quarried and crushed at Candlestick Point and used for base material in road paving projects. At Ocean Beach, a producer supplied local contractors with dune sand, chiefly for fill.

San Joaquin.—Production of natural dry gas rose 52 percent above that of 1961, to 22,300 million cubic feet. The McMullin Ranch field recorded the largest increase, to 7,620 million cubic feet from 981 million in 1961. The Lathrop field, the State's second largest dry-gas field from the standpoint of reserves, had 13 well completions although no production was reported during 1962. A pipeline connecting the field with Pacific Gas & Electric Co. facilities was nearing completion at yearend, and first deliveries were scheduled for early 1963. Forty-six dry holes were drilled, 10 fewer than in 1961. One unsuccessful exploratory well that reached basement was drilled in the north-central part of the county.

Sand and gravel producers near Tracy, Escalon, Stockton, and Lodi and Government crews and contractors produced 2.3 million tons of concrete aggregate and base course material. About 1.6 million tons was gravel, obtained principally from streambed deposits. Some prepared aggregate was transported to projects in Alameda and Stanislaus Counties. Both Holly Sugar Crop. at Tracy and Spreckles Sugar Co. at Manteca, purchased limestone for production of carbon dioxide gas and lime used in processing sugar beets. California Clay Products Co. and Stockton Building Materials Co. mined miscellaneous clay near Stockton, and Pacific Clay Products Co. mined fire clay near Tracy for making heavy clay products. Best Fertilizer Co., Lathrop, recovered byproduct agricultural gypsum in the manufacture of phosphoric acid.

San Luis Obispo.—Outputs of crude oil and natural wet gas were small in comparison to most of the other producing counties. Petroleum production was confined to small areas in the southwestern and southeastern parts of the county. Production of oil and gas declined 8 and 18 percent, respectively. One new well was completed in the Tiber area of the Edna field. Twenty dry holes were drilled, compared with two in 1961. One unsuccessful well that reached basement was drilled in the Carrizo Plains area. Union Oil Co. of California operated a 21,500-barrel-per-day coking refinery at Arroyo Grande, and the Richfield Oil Corp. natural gasoline and cycle plant near Cuyama was active throughout the year. There was virtually no change percentagewise in the output of natural gas liquids, compared with 1961. LP gas production rose less than 1 percent, while that of natural gasoline and cycle products declined 2 percent.

Sand and gravel output rose 400,000 tons, which was about double 1961 production. The increased tonnage was consumed as concrete aggregate and road base in highway construction projects, including those in the Cambria, Cayucos, and San Luis Obispo areas. Public works crews and contractors supplied a substantial part of the total. Preparation plants at Cambria, Atascadero, and San Luis Obispo supplied aggregate for commercial building and paving and for some Government projects. Dimension building stone and flagging were produced at quarries near Arroyo Grande and Paso Robles. Limestone was quarried at Adelaide and prepared for use in sugar refining,

as well as for flux and agricultural use. Quartzite quarried at Nipomo was used in making refractory brick. Quarries near Morro Bay and Nipomo were sources for riprap and fill used in harbor improvement, river embankments, and road construction.

Of five active mercury properties, only the Buena Vista mine near Klau, the State's second largest mercury producer, and the Cambria mine which produced 28 flasks, recovered more than a few flasks of the metal. Superior Gypsum Co. mined and sold agricultural gypsum from its Carisso mine near Simmler. San Luis Obispo Brick, Inc., mined miscellaneous clay for its own use near the San Luis Obispo city limits.

San Mateo.—Ideal Cement Co. produced portland cement by the wet process at Redwood City. Clays and shell dredged from the bay were used as raw materials. Bulk and bag shipments were made by rail, truck, and water to customers in California, Nevada, Oregon, Washington, Alaska, and foreign countries. During the year the company completed a 600-foot concrete wharf on its bay frontage to speed unloading of oystershell dredged from the bay. At yearend, the company was installing dust-collecting equipment and a sewage-treatment plant. Other companies also dredged oystershell from the bay, washed the shell, and shipped it to Petaluma and Alviso where it was prepared for use as poultry grit and filler in animal feeds. Stone production was virtually unchanged from 1961. A sandstone quarry near Brisbane, a limestone quarry near Rockaway Beach, and a basalt quarry near Woodside were principal sources of stone prepared for concrete aggregate and base course material. Roadstone was obtained from quarries in the Redwood City, Pescadero, and other areas.

Leslie Salt Co. harvested a large tonnage of crude salt from company evaporting ponds that extended into Alameda and Santa Clara Counties. The crude salt was processed in Leslie's Redwood City plant, and the product was prepared for out-of-State shipment and export. Merck & Co. extracted magnesia from sea water in a South San Francisco plant using a purchased limestone-dolomite mixture as a precipitant. During the year Merck increased capacity by installing larger pumping facilities. Kaiser Gypsum Co. maintained a stockpile of crude gypsum from Mexico in Redwood City for sale and use by the company.

Production of petroleum and natural wet gas declined 30 and 39 percent, respectively, from 1961 figures. The county's three small fields yielded 97,083 barrels of oil and about 12 million cubic feet of wet gas. Two new wells were completed to production, one in the Half Moon Bay field, the other in the La Honda field (south area). No exploratory wells were drilled in 1962 and no dry holes reported.

Santa Barbara.—Petroleum and both wet and dry natural gas showed substantial production gains over 1961, rising 8.5, 21, and 79 percent, respectively. Exploratory and development drilling contributed appreciably to the increases. Twenty exploratory wells were drilled, three of which resulted in discoveries. Richfield Oil Corp. discovered a new oilfield, the Alegria Offshore, and Standard Oil Co. of California opened two new gasfields, the Molino and Caliente Offshore fields. Major development drilling occurred in the Conception Offshore field, where 17 new wells were completed, and in the Summerland

Offshore field, where 11 new wells were added. Secondary recovery projects in operation at yearend included peripheral floods at the Capitan field and in the Cat Canyon group. Six plants extracted natural gas liquids from wet gas. Production of natural gasoline and cycle products rose nearly 22 percent while the output of LP gases dropped 16 percent, compared with 1961. Douglas Oil Co. of California and Union Oil Co. of California operated refineries at Santa Maria. Douglas operated a 4,500-barrel-per-day skimming and asphalt plant. A similar plant with a 4,700-barrel-per-day capacity was operated by Union.

Johns-Manville Products Corp. and Great Lakes Carbon Corp. mined and processed diatomite near Lompoc for filler, filtration, and insulation. Near Santa Maria, The Airox Co. mined and processed diatomite for lightweight aggregate and pozzolan. Sand and gravel production rose to 1.9 million tons, 1.1 million of which was gravel. City streets, county roads, and State highway projects in the Santa Maria, Santa Barbara, San Marcos Pass, Goleta, and Lompoc areas took 550,000 tons more sand and gravel than in 1961. Output of these materials for building construction rose about 150,000 tons. The major producers operated preparation plants near Sisquoc, Santa Maria, Lompoc, and Solvang. Limestone was quarried near Lompoc, and sandstone and miscellaneous stone were quarried near Carpenteria, Santa Barbara, Lompoc, and Santa Maria, for use as building stone, riprap, concrete aggregate, and base course material. Union Sugar Division, Consolidated Foods, purchased limestone and made carbon dioxide gas and lime for use in its sugar factory at Betteravia.

Santa Clara.—Permanente Cement Co. produced portland cement in its 8.5-million-barrel wet process plant at Permanente. Clinker was produced in six rotary kilns ranging in length from 444 to 454 feet. Bulk and bag shipments were made to customers in California, Nevada, Oregon, Washington, Alaska, and foreign countries. Limestone was quarried at Permanente for use in cement and for sale as base course material and fill. Miscellaneous stone was quarried for base course material in the Milpitas, San Jose, Los Altos, Palo Alto, and Saratoga areas. Stone output was more than 4 million tons, 170,000 tons above the 1961 figure, but sand and gravel production was 700,000 tons lower. The decline in sand and gravel output was attributed to a construction strike in northern California and to reduced sand and gravel requirements as aggregate for paving and road base. More sand and gravel was used in building construction than in 1961. The principal producers operated stationary and portable preparation plants near streambed deposits in the Gilroy, San Jose, Sunnyvale, and Morgan Hill areas. Remillard-Dandini Co. mined miscellaneous clay near San Jose for use in making heavy clay products. Mirassou Bros. worked the volcanic cinder deposit of Lone Hill, Inc., near Los Gatos and sold the material for decorative use.

The New Almaden and Guadalupe mines yielded all the mercury recovered in the county. There were six lessees in various areas of the New Almaden property, but Andy's Mercury Reduction Plant recovered about 92 percent of the New Almaden total, principally from ores of the San Francisco pit. The Palo Alto Mining Co. retorted ore

mined at the Guadalupe property and accounted for the balance of the metal recovered.

Santa Cruz.—Portland cement was produced by Pacific Cement & Aggregates, Inc. (PCA), in its 3-million-barrel-capacity, 6-kiln plant at Davenport. Cement was shipped by truck and rail to company concrete batching facilities and to customers in northern California. Some flue dust from the cement plant was marketed as a soil additive because of its potash content. PCA and Ideal Cement Co. mined miscellaneous clay at Davenport and San Juan Bautista, respectively, for use in making cement.

The northern California construction strike adversely affected sand production from deposits in the Felton area, yet outputs of sand near Scotts Valley and of sand and gravel near Santa Cruz for local building construction were appreciably above those in 1961. Stone production declined about 180,000 tons, mainly because of lower requirements by Government agencies for stone used to protect jetties, seawalls, and embankments. Substantial tonnages of limestone were quarried at Davenport for use in cement, and at Santa Cruz for building stone and poultry grit. Riprap and roadstone were produced at the county's Empire quarry, and from quarries near Felton and Soquel.

Shasta.—Calaveras Cement Co. produced portland cement in its Redding plant, California's newest and northernmost cement-producing facility. The 1.5-million-barrel plant, completed in December 1961, operated throughout 1962. Cement was shipped to California, Oregon, and Nevada customers. The company mined miscellaneous clay in the Redding area for use in making cement.

Less sand and gravel was produced for road construction than in 1961, and the output was limited chiefly to projects near Castella, Whiskeytown, Anderson, and O'Brien. Early 1962 completion of the Clear Creek hydroelectric project tunnel also adversely affected the total output. Larger tonnages of sand and gravel were produced for building construction, particularly for the Spring Creek power plant and for building in the Redding area. The Gray Rocks quarry was worked for limestone by Calaveras Cement for use in its cement plant. Some limestone was sold to sugar companies. Basalt and miscellaneous stone were quarried by public works crew and contractors for riprap and base course material. State highway crews mined volcanic cinder used in road maintenance. In the Glenburn area, cinder deposits were worked for material used in local road repair. Steward Masonry Supply mined the Black Butte deposit for cinder used as concrete aggregate.

Mountain Copper Co. mined and shipped pyrite fines and concentrate to Bay area chemical plants, where they were roasted as a source of sulfur for making sulfuric acid and liquid sulfur dioxide. The cinder residue was used in special cements and as a soil additive. Mountain Copper also mined and shipped iron ore from its Iron Mountain deposit. Most of the production was exported, but some was sold to a cement plant. The pyrite and iron ore mines both were shut down indefinitely at yearend. Stockpiled ore was to be shipped in 1963. Don Clifton shut down the Hirz Mountain iron property after working it for a short period early in the year. The entire output was shipped for export. Copper precipitates produced by

Mountain Copper Co., Ltd., at its Brick Flat mine near Matheson were shipped to the Tacoma, Wash., smelter for recovery of copper, silver, and lead. Ores mined in the French Gulch and Redding areas yielded gold and silver by amalgamation. Near Keswick, ore mined in 1958 was treated by amalgamation to recover gold and silver. Sluicing methods were used to recover byproduct placer gold and silver at the Shea Sand & Gravel washing plant near Redding. Stream gravels were panned at various locations by individuals who recovered small quantities of gold and silver.

Sierra.—Rex Sierra Gold Corp. received a permit from the California Debris Commission to work placer deposits at the Pleasant View claims and the Mount Alta mine a few miles north of Pike. By yearend, the company had hydraulicked 20,000 cubic yards of ancient riverbed gravels to recover gold and silver. Old tailings and dump material were treated at three old placer properties near Alleghany and some placer gold and silver were recovered. Prospectors panned stream gravels for gold and silver near Alleghany, Downieville, Gibsonville, and Poker Flat. Four lode gold mines were active, but only the Brush Creek mine near Goodyears Bar and the Original 16 to 1 mine at Alleghany yielded significant quantities of gold and silver. Sand and gravel was produced by public works crews and contractors, principally for road construction in the Sierraville, Sierra City, and Ramshorn Creek areas. Quartz was quarried at Crystal Peak and shipped to an Oregon silicon plant.

Siskiyou.—Volcanic cinder was mined for railroad ballast from the Kegg cinder pit near Bray, from the Porcupine pit near Hambone, and from the Weed and Tulelake areas for use as concrete aggregate and in road maintenance. Pumice mined near Medicine Lake and volcanic cinder mined near Yreka were sold for decorative uses. The demand for sand and gravel used in building construction and paving was supplied mainly by preparation plants at Yreka and Mt. Shasta. Other sand and gravel pits and stone quarries were worked by crews and contractors for State and county road agencies, the Bureau of Indian Affairs, and the Bureau of Reclamation for riprap, road base, and surface aggregate.

Gold ores, most of which were mined in 1961, and cleanup material at five small lode gold mines in the Yreka areas yielded relatively small quantities of gold and silver. Two small hydraulic mining operations on the Klamath River, one near Yreka and the other near the mouth of the Salmon River, recovered most of the placer gold and silver produced in the county. Individuals recovered small quantities of placer gold by panning and sluicing stream gravels on the Scott, Salmon, and Klamath Rivers.

Solano.—Solano was the second leading county in production of natural dry gas, although the volume produced was 7 percent less than that in 1961. The only field with a notable increase in output was the Bunker field, where production rose to 4,395 million cubic feet from 511 million in 1961. Major declines were recorded at the Main Prairie and Rio Vista fields. Ten exploratory wells were drilled, resulting in one discovery. Amerada Petroleum Corp. discovered the Lindsay Slough gasfield with a well completion in November. A few of the

wells also yielded small quantities of petroleum. The combined total was only 1,077 barrels for the year.

Pit-run sand and gravel was obtained near Benicia, Vacaville, and Winters (Putah Creek) and used for fill and in road repair. Basalt and miscellaneous stone were produced at the Cordelia quarry near Thomasson, the Goodyear quarry near Benicia, and at other locations, to provide roadstone, base course material, and fill.

Sonoma.—Sand and gravel production rose to 2.8 million tons, nearly 245,000 tons more than in 1961. The quantity produced for paving was up 177,000 tons; for building construction, up 113,000 tons; and for fill, down 45,000 tons. Commercial producers and Government crews and contractors operated stationary and portable preparation plants along the Russian River in the Cloverdale, Healdsburg, Windsor, and Guerneville areas. Operations at Healdsburg and Windsor were the principal sand and gravel sources. Large tonnages of these materials were used in highway construction at Santa Rosa and near Healdsburg and Duncan Mills. Basalt and miscellaneous stone quarries near Petaluma, Forestville, Occidental, and Cotati supplied riprap and road-base material. Dimension building stone and flagging were produced at quarries in the Glen Ellen area. Shale was quarried near Calistoga by Joe Malugani, Sr., and used for fill in road building.

Glenn Truitt recovered 743 flasks of mercury in furnacing ore from the Mt. Jackson mine near Guerneville. The mine was active until October 31. Harold Field furnaced ore mined from the Culver-Bear (Buckman) mercury property in the Geyser area and recovered 146 flasks of the metal. About two flasks of mercury were produced by William Head in retorting some highgrade cinnabar ore from the Socrates mine, southwest of the Geyser area. Natural dry gas was produced from the Petaluma field, the county's only gasfield. Production totaled 157 million cubic feet, up 2 percent from that of 1961. One unsuccessful exploratory well that reached basement was drilled in the Tubbs Island area.

Stanislaus.—Although road construction activity declined in 1962, sand and gravel producers prepared over 400,000 tons for road base and paving. The demand for use in building construction required more than 500,000 tons, a gain of nearly 300,000 tons over that of 1961. Overall production was only 33,000 tons more than in 1961. Stationary and portable preparation plants were operated by commercial producers and Government crews and contractors along the Tuolumne River in the Modesto, Hughson, and Waterford areas; the Stanislaus River near Riverbank, Oakdale, and Knights Ferry; and in the Newman area at Orestimba Creek.

In the Oakdale-Knights Ferry area, ball clay was mined for use in making whiteware, pottery, and floor and wall tile; miscellaneous clay was produced for making heavy clay products. The producers were E. H. Metcalf Materials and Western States Materials. Metcalf also mined fire clay for use in mortar and in compounding drilling muds. Kraftile Co. produced fire clay near LaGrange for heavy clay products manufacture.

In a plant near Modesto, Inorganic Chemicals Division, FMC Corp., prepared crude barite from the company's Nevada mine for use by the glass industry. Metal mining was limited to weekend prospectors who

panned stream gravels along the Tuolumne River. Only 2 ounces of gold was reported as having been recovered in 1962.

Sutter.—Natural dry gas production rose to 20,252 million cubic feet, nearly 17 times the output in 1961. The large increase was due directly to a greater number of producing wells. The Grimes field had 41 producing wells, 24 of which were new; Sutter Buttes field had 23 producing wells, of which 13 were new; and Sutter City field had 11 producing wells, of which 9 were new. Atlantic Oil Co. had a new pool discovery in the Butte Slough field with a well completion in September. Twenty-three dry holes were drilled in 1962, including nine tests that reached basement.

Sand and gravel production came principally from deposits in the Sutter Buttes area, worked by commercial operators and Government crews for road base and fill material. Sand and gravel preparation plants in Yuba County supplied most of the needs for aggregate used in building construction and road surfacing. Miscellaneous stone was quarried at Sutter Buttes and other locations for riprap and roadstone used in public works projects. International Pipe & Ceramics Co. mined miscellaneous clay near Nicolaus for use in making heavy clay products. Yuba Minerals & Milling Co. operated a grinding plant at Sutter. The company ground barite for its own use and for sale, but the plant was also available for custom grinding.

Tehama.—Sand and gravel was obtained from deposits along the Sacramento River near Red Bluff and from the streambed of Thomas Creek near Richfield. Preparation plants were operated by commercial producers, by crews and contractors for State and county road agencies, and by contractors for the U.S. Army Corps of Engineers and Bureau of Reclamation. Substantial tonnages of stone and sand and gravel were required for use in construction of the Red Bluff diversion dam (Central Valley Project). State highway crews dug volcanic cinder from various pits and used the material in road maintenance and repair.

Natural dry gas production was 1,920 million cubic feet, about 25 percent more than in 1961. The output came from 11 wells in 3 fields, all in the southwest corner of the county. The production increase was attributed entirely to the Kirkwood field, where five new producing wells were added in 1962 and where output was more than twice that of 1961. Fourteen dry holes were drilled, a total of 75,155 feet, and no discoveries were reported.

Trinity.—Sand and gravel production dropped to 152,000 tons from 279,000 tons in 1961. The decline was due primarily to reduced road construction. An increase in output was reported for aggregate used in structural concrete, particularly in the Weaverville and Lewiston areas. Granite and miscellaneous stone were quarried by contractors for the Bureau of Reclamation, Northwestern Pacific Railroad, and the State highway agency for riprap and roadstone. Crude barite production was reported for the first time from a deposit near Denny. W. S. White mined and shipped the mineral to a Sacramento County mill for grinding. A small tonnage of gold ore from the Layman mine, near Hayfork, was treated by amalgamation to recover gold and silver. Placer gold and silver were recovered by individuals who sluiced and panned stream gravels along the Trinity River. In

the Big Bar area, one hydraulicking operation, one suction dredge, and one bucketline dredge recovered relatively small quantities of placer gold.

Tulare.—Crude oil production was 46,416 barrels, virtually unchanged from 1961. The output was from the Deer Creek and North Deer Creek fields where 25 of 31 productive wells were active. Natural dry gas production, all from that part of the Trico field within the county, was down 16 percent from that in 1961. The decline corresponded with the general decline of the entire Trico field. Four exploratory holes were drilled in the county and abandoned as dry.

Early 1962 completion of the Terminus dam and related roads and structures, near Lemon Cove, substantially reduced the demand for sand and gravel. Other building and highway projects required about 1.8 million tons of aggregate. Stationary and portable preparation plants operated on the Kaweah River near Lemon Cove and on the Tule River near Porterville. Large tonnages of sand and gravel were used in highway construction in the Pixley, Traver, and Ivanhoe areas. Nearly 300,000 tons of stone was quarried by public works contractors and others to obtain riprap and road-base material for various projects.

Macco Corp. mined crude barite from the Barite King property in 9-Mile Canyon. Most of the output was upgraded in the Little Lake (Inyo County) jigging plant before shipment to company grinding facilities in Kern County. S. P. Brick Co. dug miscellaneous clay near Exeter for making brick and other heavy clay products.

Tuolumne.—A small tonnage of sand and gravel was obtained from stream deposits near Jacksonville, chiefly by crews and contractors of the State highway agency and contractors for the Bureau of Public Roads. Granite and miscellaneous stone were quarried by contractors for the Hetch Hetchy water project and Government agencies for riprap, roadstone, and fill. U.S. Lime Products Corp. quarried limestone at Columbia and Sonora for lime, glass, and paint manufacture and for poultry grit. Sonora Marble Aggregates Co. quarried and prepared marble for terrazzo near Sonora. U.S. Lime Products used one rotary and three shaft kilns and a continuous hydrator to make lime at Sonora for sale to the construction, agricultural, chemical, and other industries. Shale was quarried near Sonora by Pacific Clay Products Co. and used in making heavy clay products.

Tungsten ore from the High Sierra property near Pinecrest was milled, and the concentrate was shipped to an Inyo County paratungstate plant. Ores from the Soulsby Belle claim near Mono Vista, the Hidden Treasure mine near Italian Bar, and the Eureka property near Big Oak Flat were treated to recover gold and silver. Ore from the Grand Turk, mined in 1947, was treated by amalgamation in 1962 to extract gold and silver. Dump material from the Washington Salambo copper mine near San Pedro Dam was shipped to the Selby smelter, Contra Costa County. The material contained recoverable gold, silver, and copper.

Ventura.—Production of crude oil and natural gas from oil zones was 11 percent below that of 1961. The major factor in the decline was the marked drop (6,580 barrels per day) in petroleum production at the Ventura field, with a corresponding decrease in the natural wet gas

yield. The Rincon and San Miguelito fields also reported lower outputs. Natural dry gas production came entirely from three wells in the Montalvo west field and was about 43 percent above the 1961 figure. Ten plants treated wet gas to extract natural gas liquids until May, at which time Continental Oil Co. shut down its San Miguelito plant. Outputs of natural gasoline and cycle products dropped 13 percent while those of LP gases rose 16 percent.

Sand and gravel production rose to 4.5 million tons, 1.4 million above that in 1961. Of the total output, over 2.4 million tons was used in paving and 1.4 million in building construction. Most of the remainder was used as fill. The greatest demand was for paving aggregate, which was nearly 1.1 million tons above the 1961 figure. The major preparation plants were in the Ventura, Saticoy, and Santa Paula areas. Other plants were near Santa Susana, Thousand Oaks, and Moorpark. Industrial sands for blast, filter, and foundry use were produced and prepared at Santa Paula and Huntington Park. Dimension building stone, flagging, rubble, and roadstone were quarried in the Ojai, Fillmore, and Montebello areas. The Rincon and LaJolla quarries and a quarry near Camarillo were major sources for riprap used in harbor construction and road embankments. Oystershell was taken from the ancient Tapo Alto deposit and prepared for use as a mineral filler in animal feeds, for poultry grit, and as a component in fertilizers.

Shale was quarried near Ventura by Rocklite Products, Inc., and near Frazier Park by Ridgelite Products, Inc. Both companies expanded the shale for use as lightweight aggregate. Monolith Portland Cement Co. obtained gypsum at its Cuyama deposit for use as a cement retarder in its Kern County cement plant.

Yolo.—Stationary and portable preparation plants were operated by sand and gravel producers along Cache Creek in the Madison and Woodland areas to obtain concrete aggregate and base course for building construction and highway projects. Large tonnages of sand and gravel were produced for structural and paving work in connection with the new deepwater channel and harbor facilities for the Port of Sacramento, part of which is in West Sacramento, Yolo County. American Crystal Sugar Co. at Clarksburg and Spreckles Sugar Co. at Woodland burned purchased limestone to produce carbon dioxide gas and lime used in processing sugar beets.

Natural dry gas was produced from wells in five fields. Output was 54 percent more than in 1961. Virtually all of the increase resulted from the efforts of one operator in the Winters field. Two new gas discoveries were made, both by Atlantic Oil Co. The company brought in a new field (Woodland) with a well completion in September, followed by a new pool discovery in the new field with another well completion in October. Nearly 1,500 tons of new ore was furnaced with about 4,600 tons of dump material at the Reed mercury mine and mill to yield 242 flasks of mercury.

Yuba.—The bucketline dredging by Yuba Consolidated Gold Fields Division, Yuba Consolidated Industries, Inc., on the Yuba River near Marysville was the State's principal placer gold and silver operation and its leading gold producer. The company also recovered platinum-group metals at the dredging operation. The remaining placer gold

and silver was recovered by individuals who used sluiceboxes and gold pans in working stream gravels throughout the county. Ores from the Good Hope mine near Waldo Junction, the Dannebroge mine near Browns Valley, and the Paynes property near Dobbins were treated to recover gold and silver. The Good Hope ore also contained recoverable copper.

A substantial part of the 526,000 tons of sand and gravel output was supplied by preparation plants operated along the Yuba River in the Marysville area. The demand for paving aggregate was greater than in 1961, and larger tonnages were used in city, county, State, and Federal (U.S. Air Force) projects. Several producers supplied sand and gravel for aggregate used in Sutter County. Contractors for the U.S. Army Corps of Engineers quarried and used stone for riprap in flood control programs. International Pipe & Ceramics Co. mined miscellaneous clay near Wheatland for making draintile and sewer pipe.

The Mineral Industry of Colorado

By D. H. Mullen [1]

MINERAL production from Colorado mines, mills, quarries, and wells in 1962 was valued at $308.1 million, a decrease of 11 percent compared with 1961 figures. Fourteen commodities gained, 16 declined, and 2 remained unchanged in value of production; output was recorded for 1 commodity that was not produced

TABLE 1. —Mineral production in Colorado [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Beryllium concentrate---short tons, gross weight	819	(2)	782	(2)
Carbon dioxide (natural)---thousand cubic feet	167,872	$19	148,940	$15
Clays---thousand short tons	556	1,241	802	1,573
Coal (bituminous)---do	3,678	22,787	3,379	19,999
Copper (recoverable content of ores, etc.)---short tons	4,141	2,485	4,534	2,793
Feldspar---long tons	14,129	99	(2)	(2)
Gem stones	(3)	36	(3)	45
Gold (recoverable content of ores, etc.)---troy ounces	67,515	2,363	48,882	1,711
Gypsum---thousand short tons	85	320	108	383
Iron ore (usable)---thousand long tons, gross weight	27	190	(3)	(2)
Lead (recoverable content of ores, etc.)---short tons	17,755	3,658	17,411	3,204
Lime---thousand short tons	75	1,319	93	1,518
Mica (scrap)---short tons	600	10	142	2
Molybdenum (content of ore and concentrate)---thousand pounds	47,485	63,582	32,412	45,376
Natural gas---million cubic feet	108,142	12,544	101,826	11,812
Natural gas liquids:				
LP gases---thousand gallons	115,410	5,498	100,787	4,411
Natural gasoline---do	76,880	3,627	60,558	3,826
Peat---short tons	9,894	44	12,351	68
Petroleum (crude)---thousand 42-gallon barrels	46,759	134,666	[4] 42,460	[4] 122,285
Pumice---thousand short tons	44	60	76	82
Sand and gravel---do	18,360	16,946	19,313	18,926
Silver (recoverable content of ores, etc.)---thousand troy ounces	1,965	1,817	2,088	2,265
Stone---thousand short tons	2,451	5,301	2,353	5,597
Uranium ore---short tons	1,282,462	21,509	1,135,440	18,044
Vanadium---do	4,149	(2)	3,742	(2)
Zinc (recoverable content of ores, etc.)---do	42,647	9,809	43,351	9,971
Value of items that cannot be disclosed: Cement, fluorspar, perlite, pyrite, salt, tin, tungsten concentrate, vermiculite (1962), and values indicated by footnote [5]	----------	[5] [6] 36,278	----------	[7] 34,209
Total	----------	[5] 346,208	----------	308,115

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Weight not recorded.
[4] Preliminary figure.
[5] Revised figure.
[6] Value of metals, $16,806,000; value of nonmetals, $19,472,000.
[7] Value of metals; $14,632,000; value of nonmetals, $19,577,000.

[1] Mining engineer, Bureau of Mines, Denver, Colo.

in 1961. Most of the gains were in the nonmetallic minerals group of which 10 increased, 2 decreased, and 2 remained the same in value; 1 new nonmetallic mineral was produced. Of the six commodities classed as mineral fuels, only the output value of peat increased; petroleum and coal, the most important of the group, decreased along with three others. Among the 12 metal commodities, copper, silver, and zinc gained and gold, lead, molybdenum, uranium ore, vanadium, and 4 others declined in values of output compared with the 1961 figures.

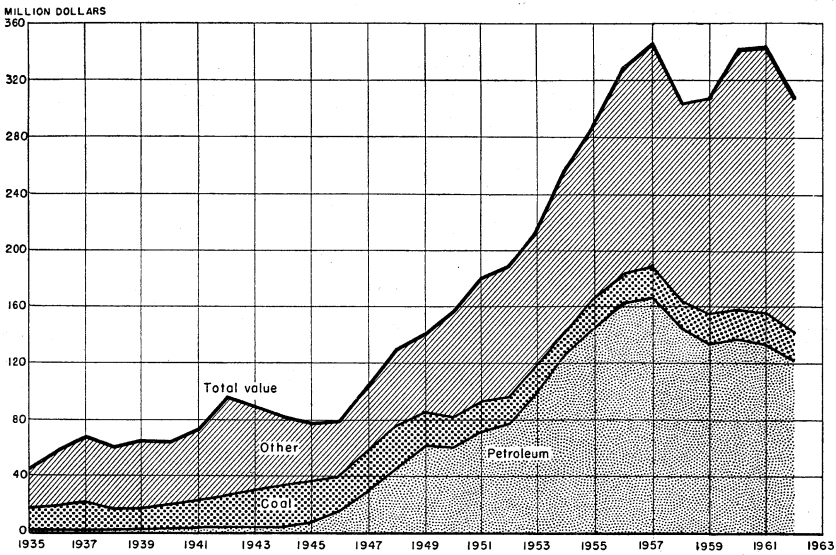

FIGURE 1.—Value of petroleum and coal and total value of all minerals produced in Colorado, 1935–62 (excludes uranium 1941–55).

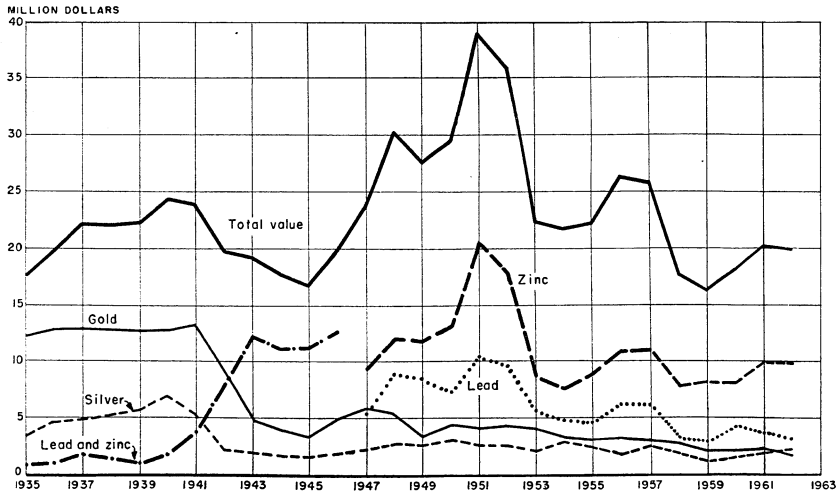

FIGURE 2.—Value of mine production of gold, silver, lead, and zinc and total value of these minerals (including copper) in Colorado, 1935–62.

The value of the mineral fuels, representing $162.4 million or 53 percent of the total value of mineral production in the State compared with $179.2 million or 52 percent in 1961, was 9 percent below that of 1961. The total value of the metals group, representing $98 million or 32 percent of the State total mineral output value compared with $122.2 million or 35 percent of the total in 1961, was 20 percent below that of 1961. The value of the nonmetallic mineral group was 6 percent more than in 1961, representing $47.7 million or 15 percent of the total for all minerals produced compared with $44.8 million or 13 percent in 1961.

Employment and Injuries.—Final data for 1961 and preliminary data for 1962 compiled by the Bureau of Mines for employment and injuries in the mineral industries in Colorado, excluding all mineral fuels except coal, are shown in table 2.

TABLE 2.—Employment and injuries in the mineral industries [1]

Industry	Number of operations	Average number of men employed	Total man-hours worked	Injuries		Frequency rate (injuries per million man-hours)
				Fatal	Nonfatal	
1961:						
Nonferrous mines, mills, and smelters (excluding uranium)	236	1,661	2,897,785	-------	207	71.4
Uranium mines and mills	356	2,662	5,173,547	4	150	29.8
Ferrous mines and mills	11	1,109	3,130,316	3	[2] 71	23.6
Sand and gravel plants	282	1,163	1,865,868	1	33	18.2
Stone quarries and plants	140	711	1,279,715	-------	32	25.0
Nonmetal mines and mills (other than sand and gravel and stone)	96	460	660,068	-------	9	13.6
Coal and coke	119	1,919	3,269,536	5	135	42.8
Total	1,240	9,685	18,276,835	13	637	35.6
1962: [3]						
Nonferrous mines, mills, and smelters (excluding uranium)	128	1,347	2,489,818	1	155	62.7
Uranium mines and mills	246	2,235	4,303,813	3	142	33.7
Ferrous mines and mills	8	843	2,077,455	2	57	28.4
Sand and gravel plants	207	997	1,830,078	1	31	17.5
Stone quarries and plants	182	770	1,258,172	-------	33	26.2
Nonmetal mines and mills (other than sand and gravel and stone)	100	388	556,563	-------	13	23.4
Coal and coke	113	1,820	2,861,896	3	115	41.2
Total	984	8,400	15,377,795	10	546	36.2

[1] Excludes employees in all mineral fuels industries except the coal industry, as well as officeworkers.
[2] Revised figure.
[3] Preliminary figures.

Government Programs.—The Government program for purchasing hand-cobbed beryl and sheet mica, administered by General Services Administration (GSA), was terminated in June. Material from Colorado deposits was sold to the buying station at Custer, S. Dak. Purchases of trimmed sheet mica and beryl of Colorado origin at the Custer buying station were relatively small.

The Office of Minerals Exploration (OME) approved three contracts for exploring mineral deposits in Colorado. An exploration contract with Bimettalist Mining Co. was executed for the exploration of a gold-silver deposit in Ouray County. The cost of the work was estimated at $26,850, of which the Government would provide 50 percent. Nye Metals, Inc., Black Hawk, was to receive financial

assistance to explore for molybdenum in Gilpin County. Under the contract, total cost of the work, which was to consist of drifting and diamond drilling, was for $76,650 with 50-percent participation each by the Government and the company. Gaddis Mining Co., Denver, signed a contract with the Government for financial assistance to explore for gold, silver, copper, lead, and zinc in Gunnison County. The program of drilling from surface locations was to cost $30,920 with equal participation by the Government and the company.

The Federal Bureau of Mines Denver office and field offices and operating groups in Tucson (Ariz.), Socorro (N. Mex.), Salt Lake City (Utah), and Laramie (Wyo.) continued its widespread and comprehensive investigations of the mineral industry in Arizona, Colorado, Nebraska, New Mexico, North Dakota, South Dakota, Utah, and Wyoming. Occurrences, reserves, utilization, operation, and economics of mineral deposits were studied. Two of the reports published included investigations made in Colorado.[2]

Mineral studies of proposed reservoir sites and other mineral investigations were made under the Interagency Missouri River Basin Project that contributed to land, water, and electric power developments by the Bureau of Reclamation, the Bureau of Indian Affairs, and the U.S. Army Corps of Engineers.

Missouri Basin Preliminary Reports, their distribution limited to Government agencies, were prepared, but none covered work in Colorado.

Laboratory and pilot-plant investigations on coal utilization were continued in Denver by the Bureau of Mines. Pilot-plant studies for producing char directly from coking coal without pretreatment were of particular interest. Other studies involved the coking perfection of selected western coals, including coal from Alaska. A study of the possibilities of utilization of lignite from Nepal was made for the U.S. Agency for International Development.

Long-range investigations were continued in Denver by the Bureau of Mines in engineering research and rock mechanics as applied to ground control. A digital computer was installed in December to provide the means of performing the numerous calculations economically.

Reports[3] of the investigations were published by the Bureau of Mines.

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[2] Kelly, F. J. Sulfur Production and Consumption in Eight Western States: Arizona, Colorado, Nebraska, New Mexico, North Dakota, South Dakota, Utah, and Wyoming. BuMines Inf. Circ. 8094, 1962, 85 pp.
Kelly, F. J. Technological and Economic Problems of Rare-Earth-Metal and Thorium Resources in Colorado, New Mexico, and Wyoming. BuMines Inf. Circ. 8124, 1962, 38 pp.

[3] Hazen, Scott W., Jr., and R. D. Berkenkotter. An Experimental Mine-Sampling Project Designed for Statistical Analysis. BuMines Rept. of Inv. 6019, 1962, 111 pp.
Hewlett, Richard F. Use of High-Speed Data Reduction and Processing in the Mineral Industry. BuMines Inf. Circ. 8099, 1962, 82 pp.
Hewlett, Richard F. Computing Ore Reserves by the Polygonal Method Using a Medium-Size Digital Computer. BuMines Rept. of Inv. 5952, 1962, 31 pp.
Wideman, F. L., and T. E. Caldwell. A Computer Program for Calculating Coordinates and Evaluations of Survey Stations Located by Intersection. BuMines Rept. of Inv. 5970, 1962, 37 pp.
Merrill, Robert H. Changes in Stress Concentration Created by Undercutting in Block Caving. BuMines Rept. of Inv. 5999, 1962, 14 pp.
Redmon, Donald E. Industrial Engineering Practice at Selected Metal Mines in Western States. BuMines Inf. Circ. 8097, 1962, 81 pp.
Utter, Stephen. Determination of Stresses Around an Underground Opening, Climax Molybdenum Mine, Colorado. BuMines Rept. of Inv. 6137, 1962, 26 pp.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Output of the mineral fuels—carbon dioxide, coal, natural gas, natural gas liquids, peat, and petroleum—was valued at $162.4 million, a decline of $16.8 million or 9 percent compared with 1961 figures. This mineral-fuels total represented 53 percent of the combined value of mineral production in the State, compared with 52 percent in 1961.

Asphalt and Related Bitumens.—American Gilsonite Co. produced gasoline, diesel fuel, and metallurgical coke at its gilsonite processing plant at Fruita. Transporting the crude gilsonite to this plant from the mine at Bonanza, Utah, through a 72-mile-long, 6-inch-diameter pipeline had proved eminently successful since operation of the pipeline began in 1957.

House Resolution 5423, approved by the President on October 11, 1962, provided for utilizing the oil-shale experimental plant at Rifle for research by private companies and educational organizations. A number of proposals received by the Secretary of the U.S. Department of the Interior for leasing the plant were being evaluated at yearend.

Carbon Dioxide.—Carbon dioxide produced from wells in the Nina View field in Las Animas County and from the McElmo field in Montezuma County was 11 percent below that of 1961. The gas was processed at plants in Bent and Montezuma Counties into dry ice and liquid carbon dioxide. Carbon dioxide, occurring in substantial quantities in oil wells in Jackson County, was vented.

Coal (Bituminous).—Coal production from 93 mines (86 underground and 7 strip mines) was 8 percent below that of 1961. Part of the decline was the result of decreased production of The Colorado Fuel and Iron Corp. (CF&I). Modernization of the corporation steel plant at Pueblo continued, and development of improved processes substantially reduced the quantity of coke required. The quantity of coal mined for use outside the State, principally for steelmaking in Utah, declined sharply. These declines in production were only partially offset by increased output of coal for use in thermal powerplants, mainly in the Denver Metropolitan area. Energy Coal Co. completed developing a new strip mine 20 miles southeast of Steamboat Springs in Routt County and began operations early in December. Public Service Co. of Colorado (PSC) completed contracts for delivering 11.9 million tons of coal over the next 15 years for use at its generating plants. Of this total, the new Energy mine was to supply 6.0 million tons, and the Pittsburg & Midway Coal Mining Co., operating the Edna strip mine at Oak Creek in Routt County, was to supply 5.9 million tons. This quantity to be supplied under the new contracts was in addition to the 1 million tons being consumed annually at the seven company-owned generating plants. A third unit (150,000 kilowatts), dedicated in August at the Cherokee plant in Denver, increased the capacity of the plant to 360,000 kilowatts. Additions and improvements to generating plants, transmission lines, and other facilities, to cost $56 million, were planned for 1963. In March, Colorado Ute Electric Association of Montrose obtained a loan of $15.6 million from the Rural Electrification Administration (REA)

to assist in constructing a 150,000-kilowatt steam-generating plant near Hayden and in building 187 miles of transmission lines. Coal for the plant was to be mined from deposits near Craig.

TABLE 3.—Coal (bituminous) production by counties
(Excludes mines producing less than 1,000 short tons)

County	1961		1962	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Delta	57,137	$5.34	65,471	$5.41
El Paso	[2] 791,462	[2] 7.35	[3] 508,396	[3] 7.71
Fremont	308,537	3.59	331,370	3.71
Garfield	16,092	7.00	10,698	7.32
Gunnison	258,766	6.34	195,021	6.57
Huerfano	46,890	6.32	43,833	5.51
La Plata	29,518	4.29	30,008	3.64
Las Animas	794,371	9.52	680,907	9.47
Mesa	123,575	5.44	112,256	5.41
Moffat	(2)	(2)	128,087	4.66
Montrose	(2)	(2)	(3)	(3)
Pitkin	(2)	(2)	(3)	(3)
Rio Blanco	10,634	6.21	(3)	(3)
Routt	446,522	3.84	486,896	3.80
Weld	794,442	4.24	786,457	4.17
Total	3,677,946	6.20	3,379,400	5.92

[1] Value received or charged for coal f.o.b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.)
[2] Production of Moffat, Montrose, and Pitkin Counties combined with El Paso County to avoid disclosing individual company confidential data.
[3] Production of Montrose, Pitkin, and Rio Blanco Counties combined with El Paso County to avoid disclosing individual company confidential data.

Natural Gas.—Dry natural gas was produced from fields in 15 counties. Most of the output was from La Plata County followed by Rio Blanco, Mesa, and Garfield. Oil well gas from fields in 8 counties was processed at 15 plants. Dry natural gas and residual gas from the processing plants were marketed through pipelines. Reports [4] showed production of dry natural gas at 60 billion cubic feet and oil well gas at 67 billion cubic feet. Plant intake was 85 billion cubic feet, which included some dry natural gas that was passed through plant compressors at the San Juan plant, La Plata County, without processing.

Natural Gas Liquids.—Natural gas liquids—butane, propane, and natural gasoline—were recovered at 15 plants in 7 counties. Reports [5] showed total natural gas intake of 85 billion cubic feet of gas, which included some dry natural gas that was passed through plant compressors at the San Juan plant, La Plata County, without processing. Total recovery from all plants was 3.8 million barrels of liquid products. N. C. Ginther sold a 50-percent interest in seven processing plants in the Colorado portion of the Denver-Julesburg basin to Associated Gas and Oil Co. of Houston, Tex. The purchase was shared with Kansas-Nebraska Natural Gas Co., which serves much of the Denver-Julesburg basin area.

[4] The Oil and Gas Conservation Commission of the State of Colorado. Oil and Gas Statistics for 1962. Pt. 1, Oil and Gas Production, 1963, 87 pp.; pt. 3, Gasoline and Extraction Plants, 1963, 4 pp.
[5] Work cited in footnote 4.

TABLE 4.—Crude petroleum production by counties[1]

(Thousand barrels)

County	1961	1962[2]	Principal fields in 1962 in order of production
Adams	909	608	Badger Creek, Windy Hill, Middlemist, Beacon.
Archuleta	89	80	Price Gramps.
Baca	34	205	Flank.
Bent	1	1	Bent's Fort, Lubers.
Boulder	3	3	Boulder.
Fremont	28	29	Florence.
Jackson	591	551	McCallum, Battleship, South McCallum.
Kiowa	10	14	Brandon.
La Plata	42	57	Red Mesa.
Larimer	137	184	Fort Collins, Wellington.
Logan	4,451	4,612	Northwest Graylin, Lewis Creek, Cliff, Minto, West Padroni, Yenter.
Moffat	1,417	995	Danforth Hills, Moffat, Iles, Buck Peak.
Montezuma	107	232	Flodine Park.
Morgan	8,947	5,529	Adena, Sand River, Zorichak, Bijou.
Prowers	1		
Rio Blanco	19,017	18,514	Rangely, Wilson Creek,
Routt	145	132	North Sage Creek, Tow Creek.
Washington	9,285	8,981	Plum Bush Creek, Big Beaver, Little Beaver, Bison, Bobcat.
Weld	1,492	1,732	Pierce, Black Hollow, Southwest Roggen.
Yuma	3	1	Laird.
Total	46,759	42,460	

[1] Based on Colorado Oil and Gas Conservation Commission county data adjusted to Bureau of Mines total.
[2] Preliminary figures.

TABLE 5.—Wildcat- and development-well completions in 1962, by counties

County	Crude	Gas	Dry	Total	Footage	County	Crude	Gas	Dry	Total	Footage
Wildcat:						Wildcat—Continued					
Adams	-----	----	19	19	102,700	Yuma	-----	----	15	15	68,100
Archuleta	-----	----	2	2	1,500						
Baca	-----	3	16	19	99,200	Total	18	14	350	382	1,906,000
Bent	-----	----	2	2	8,700						
Costilla	-----	----	1	1	1,000	Development:					
Delta	-----	----	1	1	800	Adams	3	----	9	12	70,800
Dolores	-----	----	1	1	8,900	Archuleta	-----	1	----	1	7,800
Elbert	-----	----	3	3	8,900	Baca	5	6	4	15	63,600
Garfield	-----	----	2	2	7,900	Bent	-----	3	----	3	14,900
Grand	-----	----	1	1	7,900	Elbert	-----	----	1	1	7,100
Gunnison	-----	----	1	1	3,400	Fremont	1	----	----	1	1,900
Jackson	-----	----	3	3	16,200	Garfield	-----	3	----	3	23,800
Kiowa	-----	----	3	3	15,400	Jackson	7	1	3	11	61,000
Kit Carson	-----	----	1	1	5,500	Kiowa	1	----	2	3	11,500
La Plata	1	2	3	6	13,600	La Plata	7	44	4	55	310,100
Larimer	1	----	1	2	12,700	Logan	14	----	18	32	167,000
Logan	1	2	39	42	209,300	Mesa	-----	2	3	5	27,500
Mesa	-----	3	4	7	38,300	Moffat	4	2	3	9	46,900
Moffat	2	2	17	21	137,100	Montezuma	3	----	5	8	27,500
Montezuma	-----	----	3	3	11,500	Morgan	8	3	24	35	199,400
Montrose	-----	----	2	2	22,600	Prowers	-----	----	1	1	4,700
Morgan	3	2	32	37	213,400	Rio Blanco	8	5	21	34	120,400
Pitkin	-----	----	1	1	400	Routt	1	----	----	1	6,300
Prowers	-----	----	3	3	16,400	Sedgwick	-----	1	----	1	3,400
Rio Blanco	-----	----	11	11	61,000	Washington	[1] 49	----	64	113	531,800
Routt	1	----	5	6	27,200	Weld	[2] 16	3	13	32	214,300
San Miguel	-----	----	1	1	10,100						
Sedgwick	-----	----	2	2	7,300	Total	[3] 127	74	175	376	1,921,700
Washington	6	----	141	147	657,100						
Weld	3	----	14	17	111,900	Total all drilling	[3] 145	88	525	758	3,827,700

[1] Includes 1 service well.
[2] Includes 1 condensate well.
[3] Includes 1 service well and 1 condensate well.

Source: Oil and Gas Journal.

TABLE 6.—Oil and gas discoveries in 1962

County and field	Well	Operator	Location			Producing formation	Producing interval (feet)	Total depth (feet)	Initial production		Completion date	Remarks
			Section	Township	Range				Barrels oil per day	Thousand cubic feet gas per day		
Baca County:												
Walsh	No. 1 Griffin	Henry Frost Oil Properties, Ltd.	15	33 S	43 W	Topeka	3,148–3,158	5,502	-----	2,400	June 14	
Flank	No. 1–6 Nicodemus	Horizon Oil & Gas Co.	6	34 S	42 W	Wabaunsee	2,920–2,928	4,750	-----	910	June 24	New producing horizon.
Do	No. 1–8 Colvin	Shell Oil Co	8	34 S	42 W	Cherokee	4,102–4,108	4,760	-----	1,252	May 21	Do.
LaPlata County:												
Ignacio-Blanco	No. 2–11 Animas River.	Compass Exploration, Inc.	11	33 N	10 W	Fruitland	2,133–2,376	2,376	-----	398	Mar. 21	New producing horizon—open hole.
Gallup Discovery.	No. 1 L & S	Leon W. Luska	7	33 N	11 W	Gallup	2,480–2,780	2,780	4	-------	July 26	Pumped—open hole.
Logan County:												
Warrior	No. 1 Hendricks	Canyon Oil Co	14	9 N	54 W	Dakota J	5,126–5,130	5,184	105	-------	June 23	Pumped—new producing horizon.
J Sand Discovery.	No. 1 Sanders	Regal Drilling Co., et al.	28	10 N	54 W	do	5,120–5,124	5,420	-----	4,000	Jan. 3	
Vista Area	No. 1 Reiners	Griffex, Tom Vessels, Jr., Bass & Brown.	1	11 N	54 W	Dakota D	5,581–5,585	5,765	-----	2,711	Aug. 14	
Falcon	No. 1 Fehringer-B	Stuarco Oil Co., Inc., Murfin Drilling Co.	34	12 N	52 W	Dakota J	5,217–5,221	5,266	75	-------	Apr. 10	Pumped—new producing horizon.
Bravo	Davis	Universal Petroleum Co.	11	8 N	55 W	do	5,238–5,243	5,383	23	3	Dec. 27	Old well work over.
Saber	Cervi	Bright & Schiff	7	10 N	55 W	Dakota D	5,614–5,617	5,675	75	82	Dec. 13	
Mesa County: Mancos Discovery.	No. 1 Heffelmire-Government.	Texaco Inc	32	9 S	97 W	Mancos	3,586–3,599	7,580	-----	105	May 28	
Moffat County:												
Williams Fork	No. 1 Helmke-Government.	do	18	5 N	91 W	Dakota	6,047–6,065	6,985	517	-------	Oct. 21	Pumped.
Moffat (Niobrara).	No. 1 Carpenter	Sentinel Oil Co., Inc.	33	5 N	91 W	Niobrara	2,427–2,550	2,550	154	-------	Nov. 28	Pumped—open hole.

North Craig Area.	No. 1-30 Fox	United States Smelting Refining & Mining Co.	30	8 N	90 W	Lewis	3,524-3,532	8,460		2,750	Nov. 13	
Irish Creek Unit	No. 1 Irish Creek-State.	True Oil Co	21	12 N	99 W	Fort Union	5,998-6,023	8,125		420	Dec. 15	Open hole.
Morgan County:												
Hunter	No. 1 Bolinger	Allison Drilling Co., Inc.	31	1 N	55 W	Dakota J	4,996-5,000	5,089	36	2,500	Sept. 19	
Jubilee	No. 1 Davie	W. C. Poole III, Bruce Anderson, Exeter Drilling Co.	12	2 N	55 W	Dakota D	4,920-4,924	5,040	145		Dec. 11	Pumped.
Sentry	No. 27 Huey	H. L. Hunt	28	2 N	56 W	do	5,134-5,140	5,322	50		Feb. 12	Do.
Bijou South	No. 1 Reid	Monsanto Chemical Co.	20	4 N	59 W	do	6,080-6,086	6,190		10,500	Apr. 25	
Routt County: Hidden Valley Area.	No. 1 Bridges	Alamo Corp	20	8 N	86 W	Mancos	2,169-2,188	2,188	22		Oct. 22	Pumped—open hole.
Washington County:												
Harrisburg	No. 1 Claney	Tipps Drilling Co., Inc.	32	2 S	52 W	Dakota J	4,405-4,407	4,470	15		Jan. 9	Abandoned.
Oxbow	No. 1-B Wagers	S. D. Johnson	9	2 S	56 W	do	5,215-5,228	5,317	40		July 13	Pumped. Old well work over.
Cope	No. 3 Wiant	S. D. Johnson, United States Smelting Refining & Mining Co.	33	3 S	49 W	do	3,591-3,596	3,635	120		Feb. 12	Pumped.
Pod	No. 1 Schwartz	S. D. Johnson	28	3 S	50 W	do	3,882-3,885	4,025	70		Jan. 17	Do.
Trader	No. 1 Marick	Kingwood Oil Co	3	3 S	52 W	do	4,298-4,301	4,400	56		July 8	Do.
Blade	No. 1 Whitaker	Allison Drilling Co., Inc., Webb Resources, Inc.	2	4 S	53 W	do	4,478-4,482	4,561	275		Mar. 4	Do.
Weld County:												
New Raymer	No. 1 Lewis	Texota Oil Co	12	7 N	58 W	do	6,329-6,331	6,390	231		Jan. 22	Pumped. New producing horizon.
Tempest	No. 1 Bauman	Drilling & Exploration Co.	10	11 N	61 W	do	7,765-7,775	7,817	6		Aug. 12	Pumped.
Mustang	No. 1 Union Texas-Government.	Petroleum, Inc	31	12 N	58 W	Dakota D	7,000-7,004	7,160	250		Oct. 10	Flowed.

Source: Colorado Oil and Gas Conservation Commission, Annual Report 1962.
Petroleum Information, 1962 Résumé, Oil and Gas Operations in the Rocky Mountain Region.

Peat.—Peat production from deposits in Boulder, Gilpin, and Teller Counties was 25 percent above that of 1961. The material was used as a vehicle for organic fertilizers and for soil conditioning.

Petroleum.—Petroleum production, from 2,564 wells in 301 fields, was 9 percent or 4.3 million barrels below that of 1961. Much of the decline was at the Adena field in Morgan County and, to a lesser extent, at the Rangely field in Rio Blanco County. Petroleum from both of these fields, the largest sources in the State, was produced by secondary-recovery operations. Total production of the Adena and Rangely fields had been 386 million barrels, or 56 percent of the total petroleum production in the State. Production from other fields also declined, and output from new discoveries did not offset the drop from older fields.

Drilling was 14 percent greater than in 1961, with an increase in the number of wells drilled in eastern Colorado and a decline in western Colorado. Washington County, and, to a lesser extent, Logan, Morgan, and Weld Counties were the sites of extensive exploratory and development drilling. Of the 243 exploratory wells completed in the 4 counties, 13 were oil wells and 4 gas wells. Included among 212 development wells completed were 86 oil wells and 6 gas wells. In western Colorado, drilling was largely confined to Rio Blanco and Moffat Counties with 75 wells completed (32 exploratory and 43 development). Exploratory drilling resulted in two oil and two gas discoveries. Infield drilling resulted in 12 oil and 7 gas wells. A major development drilling program of 55 wells in the San Juan basin in La Plata County was completed, resulting in 44 gas wells and 7 oil wells. Total drilling in the State was 3.8 million feet—1.9 million feet exploratory drilling and 1.9 million feet development drilling—compared with 3.2 million feet in 1961. The overall success ratio of drilling in 1962 was 30.6 percent—8.4 percent for exploratory drilling and 53.2 percent for development drilling. Important discoveries were the Blade field in Washington County, the Mustang in Weld County, the Williams Fork in Moffat County, and the gas discovery in the Fruitland formation in the Ignacio-Blanco field in La Plata County.

Five refineries in the Denver area and one each at Rangely and Alamosa were operated the entire year. Combined throughput was 13.3 million barrels of crude oil, compared with 13.2 million barrels in 1961. Total capacity of all refineries was 45,300 barrels per stream day.

METALS

Beryllium.—Beryllium-concentrate (beryl) production from mines in five counties was 782 tons, a 5-percent decline below that of 1961; the concentrate consisted of 22 tons of beryl containing 12.6 percent BeO and 760 tons of beryl-bertrandite material containing about 3 percent BeO. Major production came from the Boomer Lode mine in Park County and the Mica Lode in Fremont County. The 100-ton-per-day concentrating plant on Badger Flats near St. George was operated by Mineral Concentrates and Chemical Co., Inc. (Mincon). Ores from the Boomer Lode and from other operations were processed. The concentrate was shipped to the Mincon plant at Loveland for final processing to produce high-purity beryllium compounds.

Cadmium, Indium, and Thallium.—American Smelting and Refining Co. (Asarco) recovered cadmium, indium, and thallium compounds

TABLE.—Mine production of gold, silver, copper, lead, and zinc in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1953–57 (average)	120	17	1,071	97,907	$3,427	2,692	$2,437
1958	91	17	869	79,539	2,784	2,056	1,860
1959	65	16	769	61,097	2,138	1,341	1,213
1960	70	15	809	61,269	2,144	1,659	1,502
1961	57	19	938	67,515	2,363	1,965	1,817
1962	25	16	872	48,882	1,711	2,088	2,265
1858–1962	[3]	[3]	[3]	40,662,968	917,081	770,554	604,301

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	4,226	$2,851	19,248	$5,507	39,111	$9,383	$23,605
1958	4,193	2,206	14,112	3,302	37,132	7,575	17,727
1959	2,940	1,805	12,907	2,969	35,388	8,139	16,264
1960	3,247	2,085	18,080	4,231	31,278	8,070	18,032
1961	4,141	2,485	17,755	3,658	42,647	9,809	20,132
1962	4,534	2,793	17,411	3,204	43,351	9,971	19,944
1858–1962	307,706	99,367	2,796,489	334,151	2,010,854	377,904	2,332,804

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old slag, or tailings shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed.
[3] Data not available.

and metals at its Globe smelter in Denver from flue dust, dross, and other byproduct materials received from company and other smelters and processing plants. Output of these metals was not included in the State value of mineral production total because the origin of the material was unknown.

Gold, Silver, Copper, Lead, and Zinc.—Production of gold, silver, copper, lead, and zinc in Colorado was largely the output of mines operated primarily for copper-bearing lead and zinc ores. Because these metals were recovered either as major products, coproducts, or byproducts of the principal mines, discussion of these metals as a group provides a comprehensive account of the year's activities at the State base-metal and precious-metal mines.

Except for a small quantity of gold and silver recovered as byproducts of sand and gravel washing and screening operations (5 each in Adams and Jefferson Counties and 1 in La Plata County) from 5 placer (2 in Gilpin County and 1 each in Lake, San Miguel, and Summit Counties), and from cleanup of the Arkansas Valley smelter at Leadville (Lake County), the Carlton cyanide plant near Cripple Creek (Teller County), and other miscellaneous operations, all gold, silver, copper, lead, and zinc production was from 25 lode mines in 12 counties.

Primarily because of the closing of the Carlton mill at the end of 1961 and cessation of all mining activity in the Cripple Creek District, the State production of gold dropped to 48,882 ounces, a decline of 28 percent, compared with 1961 production. Largely because of an increase in the output of silver-bearing copper ores in Eagle County and silver-bearing copper-lead-zinc ores in Ouray and San Miguel

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1962, by counties, in terms of recoverable metals

County	Mines producing [1]		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
Adams		5		868	$30,380	121	$131
Clear Creek	7		2,188	89	3,115	61,207	66,410
Dolores	2		13,998	46	1,610	31,523	34,202
Eagle	1		313,157	5,500	192,500	882,974	958,027
Gilpin	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Grand	1		93				
Gunnison	1		1,704	106	3,710	269	292
Jefferson		5		666	23,310	105	114
Lake		1	4,187	972	34,020	55,018	59,695
La Plata	1	1	22	16	560	55	60
Mineral	1		44,382	570	19,950	276,356	299,846
Ouray	3		211,378	12,560	439,600	339,886	368,776
Pueblo			23	1	35	95	103
San Juan	4		42,716	411	14,385	31,306	33,967
San Miguel	[3] 3	[3] 3	[3] 237,642	[3] 14,183	[3] 496,405	[3] 407,629	[3] 442,278
Summit	1	1	6	4	140	170	184
Teller			229	12,890	451,150	1,099	1,192
Total:							
1962	25	16	871,725	48,882	1,710,870	2,087,813	2,265,277
1961	57	19	938,240	67,515	2,363,025	1,965,021	1,816,642

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Adams							$30,511
Clear Creek	2	$1,478	28	$5,226	20	$4,531	80,760
Dolores	5	2,895	782	143,952	681	156,722	339,381
Eagle	1,080	665,188	3,791	697,480	25,986	5,976,757	8,489,952
Gilpin	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Grand	1	431					431
Gunnison			1	92			4,094
Jefferson							23,424
Lake	51	31,416	415	76,424	94	21,712	223,267
La Plata	(4)	31	1	212	(4)	12	875
Mineral	217	133,949	1,967	361,965	2,324	534,416	1,350,126
Ouray	1,356	835,235	4,363	802,773	5,924	1,362,647	3,809,031
Pueblo	(4)	123	1	120	9	2,093	2,474
San Juan	39	23,901	789	145,157	1,052	241,856	459,266
San Miguel	[3] 1,783	[3] 1,098,297	[3] 5,271	[3] 969,901	[3] 7,261	[3] 1,669,972	[3] 4,676,853
Summit			2	322	(4)	12	658
Teller							452,342
Total:							
1962	4,534	2,792,944	17,411	3,203,624	43,351	9,970,730	19,943,445
1961	4,141	2,484,600	17,755	3,657,530	42,647	9,808,810	20,130,607

[1] Operations at slag dumps and old mill or miscellaneous cleanups not counted as producing mines.
[2] Does not include gravel washed.
[3] Production of Gilpin and San Miguel Counties combined to avoid disclosing individual company confidential data.
[4] Less than 0.5 ton.

Counties, silver production increased 6 percent. The price of silver fluctuated during the year, reaching a high of $1.22 per ounce on October 19 and closing at $1.205. The annual weighted average price was $1.085 per ounce, compared with $0.92449 per ounce for 1961. Copper production increased 9 percent over that of 1961, and the annual weighted average price was $0.308 per pound, an increase over the 1961 price of $0.300 per pound. Lead production declined 2 percent below that of 1961; the annual weighted average price was $0.092 per pound, a decrease from the 1961 price of $0.103. Zinc production was 2 percent above that of 1961; the annual weighted average price was $0.115 per pound, the same as that of 1961.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	7	3,806	435	553	400	4,600	1,800
Dry gold-silver and dry silver [2]	4	1,863	52	61,164	4,800	46,000	39,400
Total	11	5,669	487	61,717	5,200	50,600	41,200
Copper and copper-lead-zinc [2]	5	418,259	27,839	1,281,205	7,728,300	17,695,900	24,197,500
Lead	5	2,093	80	3,831	5,200	83,500	26,600
Lead-zinc	5	441,255	5,009	684,563	1,226,800	16,148,000	62,229,600
Total	15	861,607	32,928	1,969,599	8,960,300	33,927,400	86,453,700
Other lode material:							
Gold cleanup	(3)	1	4	1			
Gold mill cleanup	(3)	229	12,890	1,099			
Copper-lead cleanup	(3)	2	2	43	100	2,300	100
Lead cleanup	(3)	7		3		9,700	
Lead smelter cleanup	(3)	4,187	969	55,018	102,000	830,700	188,800
Zinc cleanup	(3)	23	1	95	400	1,300	18,200
Total		4,449	13,866	56,259	102,500	844,000	207,100
Total lode material	25	871,725	47,281	2,087,575	9,068,000	34,822,000	86,702,000
Placer	16		1,601	238			
Total all sources	41	871,725	48,882	2,087,813	9,068,000	34,822,000	86,702,000

[1] Detail will not necessarily add to totals because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] From properties not classed as mines.

Virtually all of the production of gold, silver, copper, lead, and zinc was from 19 mines in 7 counties, although additional production was reported from 6 mines in 5 other counties. Mines accounting for most of the State output were Camp Bird, Ouray County; Cascade, Clear Creek County; Eagle, Eagle County; Emperius, Mineral County; Idarado, Ouray and San Miguel Counties; Rico Argentine, Dolores County; and Sunnyside, San Juan County. Output at these seven mines, compared with total production in the State, represented 67 percent of the gold, 97 percent of the silver, 99 percent of the copper, 97 percent of the lead, and 99.7 percent of the zinc. Increases in the value of production of copper, silver, and zinc largely offset the declines in gold and lead so that the combined value of these metals was less than 1 percent below that of 1961. The increase in the price of silver apparently did not result in a substantial increase in production, although it did generate interest in mines in many districts that had been shut down. Rehabilitation work and reopening of some mines were under consideration; but the price of copper, lead, and zinc was viewed as a major controlling factor.

Iron Ore.—Brown iron ore produced at mines in San Juan and San Miguel Counties was used for paint pigments. No report was made of production or shipments of iron ore from the Cooper Fork deposit above Ashcroft in Pitkin County by the Pitkin Iron Corp. Iron ore shipments in 1962 were below those of 1961.

Molybdenum.—Production of molyblenum all came from the Climax Molybdenum Co., Climax Division, American Metal Climax, Inc. (Amax), Climax mine in Lake County. According to the 1962 annual

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1962, by types of material processed and methods of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation:					
Ore	5,556	2,005			
Cleanings	4	1			
Total	5,560	2,006			
Cyanidation: Cleanings	3,367	318			
Total recoverable in bullion	8,927	2,324			
Concentration, and smelting of concentrates: Ore	23,121	1,390,586	7,183,900	33,805,700	86,460,500
Direct-smelting:					
Ore	4,738	638,725	1,781,600	172,300	34,400
Cleanings	10,495	55,940	102,500	844,000	207,100
Total	15,233	694,665	1,884,100	1,016,300	241,500
Placer	1,601	238			
Grand total	48,882	2,087,813	9,068,000	34,822,000	86,702,000

report of the company to stockholders, mine production was 8,185,000 tons of ore from which 32,659,000 pounds of molybdenum was recovered, one-third less than in 1961. Following the expiration of the 2-year labor contracts, the two principal unions at the Climax mine went on strike July 19. Supervisory personnel resumed operations on October 29 to maintain the mine and plant through freezing weather. The company reported that within 4 days output reached 75 percent of normal. Through selective mining of higher grade ores and deferment of advance preparation and nonproductive work, a high rate of output was maintained throughout the remainder of the year. At the close of the year, negotiations were continued with the unions involved, indicating the possibility of a settlement early in 1963.

Tin and Tungsten.—Byproduct tin and tungsten were recovered from the flotation tailing at the Climax mine by Climax Molybdenum Co. Because of the strike that curtailed operations at the mine from July 19 throughout the year, the recovery of tin and tungsten declined compared with the 1961 figures. According to the 1962 annual report of the company to stockholders, tungsten production at Climax totaled 878,000 pounds, nearly 40 percent below the 1961 production of 1,433,000 pounds. The value of recorded production of tungsten declined because of lower prices. The company reported that tungsten prices fell sharply during the latter part of the year because of substantial sales by Sino-Soviet bloc countries in the free world market. The company sold its tin concentrate to Fred H. Lenway & Co., Inc., of San Francisco, Calif., for upgrading in a mill near Boulder. Lenway sold the upgraded concentrate to a number of U.S. consumers.

Uranium Ore.—Uranium ore production, all from 12 counties, was 11 percent below that of 1961. The value of the contained uranium oxide declined 16 percent. The value of uranium oxide concentrate recovered from ores of Colorado origin in 1962 was $35.6 million. The post-1962 program of procurement of uranium oxide concentrate by the U.S. Atomic Energy Commission (AEC), effective April 1, provided for the delivery of specified quantities of uranium oxide at a

TABLE 11.—Mine production of uranium ore, by counties[1]

County	1961				1962			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]
Boulder	1	11,436	82,085	$356,803	2	772	6,760	$29,788
Clear Creek	1	6	14	35				
Fremont	16	29,984	128,466	502,862	12	7,191	48,895	207,698
Hinsdale	1	(3)	(3)	(3)				
Huerfano					1	(3)	(3)	(3)
Jefferson	6	28,027	328,439	1,492,469	5	16,766	225,260	1,034,009
Mesa	74	98,521	595,241	2,533,019	50	94,139	529,863	2,228,062
Moffat	16	(3)	(3)	(3)	30	(3)	(3)	(3)
Montrose	299	538,698	2,751,661	11,396,284	198	513,148	2,444,778	9,924,790
Park					1	95	341	1,231
Pueblo	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Rio Blanco	7	1,946	8,676	34,163	3	(3)	(3)	(3)
Saguache	6	126,825	426,267	1,387,009	5	(3)	(3)	(3)
San Miguel	94	142,161	686,840	2,815,909	72	136,697	643,272	2,615,036
Teller	1	8	29	104				
Undistributed		304,850	532,217	990,024		366,632	806,216	2,003,254
Total	523	1,282,462	5,539,935	21,508,681	380	1,135,440	4,705,385	18,043,868

[1] Receipts at mills based on data supplied to the Bureau of Mines by AEC.
[2] F.o.b. mine value; base price, grade premiums, and exploration allowance.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

uniform price of $8.00 per pound. Adjustments of operating rates to meet the schedules of uranium oxide delivery resulted in curtailed operations at some mines. Also the rate of payment for crude ore established by AEC under Circular 5 and Circular 5 revised was no longer effective, although most mills continued to purchase ores from independent operators at nearly the same rate of payment. The elimination of haulage allowances, development allowances, and other payments established by Circular 5 forced the shutdown of some marginal mines. On November 17, AEC announced a new program[6] for domestic uranium procurement. The new program provided for deferring delivery of a part of the uranium oxide that was to be delivered in 1965 and in 1966 to 1967 and to 1968 at the established rate of $8.00 per pound. An additional amount of uranium oxide equal to the amount deferred to 1967 and to 1968 was to be purchased by AEC in 1969 and in 1970 at a price based on actual production costs but not to exceed $6.70 per pound. The effect of the proposed program was to extend the procurement of uranium oxide through 1970 but at a lower rate than that provided for in existing purchase contracts that terminate on December 31, 1966. Estimates[7] and forecasts by AEC indicate that by 1970 the demand for uranium oxide for use in reactors for power generators will have increased to a level where the domestic production of uranium oxide can be sustained without dependence on military procurement. Participation in the program was to be optional; mill operators were evaluating the possible effect of the program on anticipated operating rates.

[6] U.S. Atomic Energy Commission. Major Activities in the Atomic Energy Programs January–December 1962. January 1963, pp. 209–211.
[7] Johnson, Jesse C. The Uranium Industry and Its Potential Market. National Western Mining Conference, Denver, Colo., U.S. Atomic Energy Commission release No. S–7–63, Feb. 8, 1963, 9 pp.

Vanadium.—Vanadium occurring in uranium ores was recovered from those ores that were processed at mills with vanadium-recovery units. The quantity recovered from ores of Colorado origin, 10 percent below that of 1961, paralleled the decline in the production of uranium ore.

NONMETALS

Cement.—Portland and masonry cement production by Ideal Cement Co. at Portland in Fremont County and LaPorte in Larimer County was 2 percent above that of 1961. Portland cement clinker was used as a base in producing masonry cement at the Portland plant. Most of the output was used in Colorado; shipments also were made to consumers in Idaho, Kansas, Nebraska, Nevada, New Mexico, Utah, and Wyoming.

Clays.—The quantity of bentonite, fire clay, and miscellaneous clay produced in 12 counties was 44 percent above that of 1961; value increased only 27 percent, primarily because 77 percent of the material classified as fire clay was used in manufacturing heavy clay products rather than in refractory uses. Major production and use of fire clay for manufacturing refractory clay products was in Fremont and Pueblo Counties. Fire clay production from Boulder, Douglas, and Jefferson Counties was used mainly for manufacturing heavy clay products. Forty-two percent of the miscellaneous clay production was used in manufacturing heavy clay products; the remainder was used in producing lightweight aggregate. Bentonite from Fremont County was used for lining stock ponds and irrigation ditches to prevent water seepage.

TABLE 12.—Clay production by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Arapahoe	2,400	$3,600	400	$600
Boulder	(1)	(1)	27,496	61,124
Custer	1,575	5,355	492	1,673
Douglas	71,375	181,505	92,818	236,669
Elbert			(1)	(1)
El Paso	(1)	(1)	13,554	48,825
Fremont	16,611	61,174	25,103	100,653
Huerfano	4,215	(1)	(1)	(1)
Jefferson	365,001	647,619	554,009	832,361
Las Animas	9,372	28,116	21,947	45,480
Mesa	(1)	(1)	(1)	(1)
Pueblo	(1)	(1)	47,104	171,611
Undistributed	85,528	313,677	18,951	73,724
Total	556,077	1,241,046	801,874	1,572,720

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Feldspar.—Feldspar production, all from Chaffee County, was 32 percent below that of 1961. The entire output was ground and shipped to plants in Oklahoma and Texas for use in manufacturing glass.

Fluorspar.—Fluorspar production, from mines in Boulder and Jackson Counties, 3 percent below that of 1961, was consumed by the producers manufacturing hydrofluoric acid at aluminum plants outside the State.

Gem Stones.—A great variety of gem stone material and mineral specimens was collected by gem shops, gem societies, and individuals, in 32 counties. The value of the material and specimens collected was 25 percent greater than that of 1961.

Gypsum.—The State's five producers of gypsum, all located in Fremont and Larimer Counties, had a total output of 108,000 tons, a 27-percent gain over that of 1961. A part of the output was calcined and used in manufacturing wallboard, lath, and other building products. The remainder was used as a retarder in portland cement and as a soil conditioner.

Lime.—Lime was produced at 15 plants in 13 counties; output was 24 percent above that of 1961. All of the lime at 12 plants was used for refining sugar. Quicklime for metallurgical use was produced at one plant; two plants produced quicklime and hydrated lime for use in the construction and agriculture industries and at chemical plants.

Mica.—The State's entire scrap-mica output, all produced at the Langston mine in Larimer County by Jolex Mica Co., Inc., was 76 percent below that of 1961. A small quantity was sold as crude mica; the remainder was ground at the company-owned plant at Fort Collins for use in well drilling.

Perlite.—Crude perlite production, which came from Custer County, was 25 percent greater than that of 1961, was expanded at a plant in Fremont County for use as aggregate in plaster and concrete, for use as a soil conditioner, and for use in several types of insulation. Plants in Denver and Conejos Counties expanded crude perlite from deposits in New Mexico. Principal uses of the processed product were for fireproofing, as a filter aid, and in building plaster and oil-well cement.

Pumice and Pumicite.—Production of scoria and volcanic cinders, mined from deposits in Costilla, Eagle, and Routt Counties, was 73 percent greater than in 1961. Main uses were for road ballast and as concrete aggregate and roofing gravel.

Pyrite.—Pyrite production from mines in Dolores and Lake Counties was 24 percent above that of 1961. Rico Argentine Mining Co. produced pyrite at its mine in Dolores County for manufacturing sulfuric acid in a company-owned plant at the mine. The sulfuric acid was used at uranium processing plants in southwestern Colorado and adjoining States. Climax Molybdenum Co. recovered pyrite from the flotation tailing at its molybdenum mill in Lake County and stockpiled it at the mill. Pyrite from this stockpile was used for manufacturing sulfuric acid by General Chemical Division, Allied Chemical Corp., at its Denver plant.

Salt.—Salt output, all recovered from brine pumped from a well in Montrose County by Union Carbide Nuclear Co. Division, Union Carbide Corp., remained the same as in 1961. The salt was used at company-owned uranium-ore processing plants at Rifle and Uravan.

Sand and Gravel.—Sand and gravel was produced in 60 counties; output was 5 percent greater than that of 1961. The 12-percent increase in value of output reflected the higher specifications being imposed on the quality of building material. Production was by 94 commercial and 98 Government-and-contractor operators. Output by and for Government agencies represented 45 percent of the total of which 64 percent was for the Colorado Department of Highways; 28 percent for county highway departments; 4 percent for municipal

governments; and 4 percent for Federal agencies. Of the total production, 67 percent was used for paving; 29 percent for building; and the remainder for industrial sand, railroad ballast, fill, and other purposes. Prices for sand and gravel ranged from a low of $0.53 per ton for paving sand by Government-and-contractor operators to a high of $7.00 per ton for specially prepared industrial sand. The average value of all sand and gravel produced was $0.98 per ton. Commercial sand and gravel had an average value of $1.11 per ton, whereas the average value per ton for sand and gravel produced by Government-and-contractor operators was $0.82. Sand and gravel used by Federal agencies was for construction by the Bureau of Public Roads and the Bureau of Reclamation. Major production came from Adams, Jefferson, and Arapahoe Counties, which were the source of all sand and gravel used in the Denver Metropolitan area, comprising Denver County and the populated areas of the adjacent counties of Adams, Arapahoe, and Jefferson. Other counties with substantial production were El Paso, Montezuma, and Weld Counties.

TABLE 13.—Sand and gravel production in 1962, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Adams	3,644	$3,642	La Plata	178	$174
Alamosa	227	114	Larimer	468	645
Arapahoe	1,482	1,854	Las Animas	280	206
Archuleta	37	43	Lincoln	78	89
Baca	10	6	Logan	163	119
Bent	1	1	Mesa	642	533
Boulder	591	696	Mineral	43	43
Chaffee	115	130	Moffat	301	250
Cheyenne	55	74	Montezuma	960	1,177
Clear Creek	21	21	Montrose	232	219
Conejos	3	3	Morgan	222	168
Costilla	244	167	Otero	123	83
Crowley	3	2	Ouray	2	2
Custer	37	60	Park	8	6
Delta	187	213	Phillips	505	364
Dolores	90	59	Pitkin	135	124
Douglas	553	587	Prowers	73	99
Eagle	49	64	Pueblo	722	696
Elbert	11	8	Rio Blanco	238	242
El Paso	917	704	Rio Grande	(1)	(1)
Fremont	46	59	Routt	431	344
Garfield	378	322	Saguache	2	4
Grand	37	49	San Juan	32	14
Gunnison	198	212	San Miguel	46	39
Hinsdale	30	34	Sedgwick	55	27
Huerfano	257	186	Summit	294	256
Jackson	32	20	Washington	1	1
Jefferson	2,422	2,539	Weld	818	741
Kiowa	205	139	Yuma	221	113
Kit Carson	22	11	Undistributed	35	28
Lake	101	101			
			Total	19,313	18,926

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Construction of Federal-Aid State, county, and municipal highways continued at a high rate. Reports [8] showed that during the year 24.8 miles of the National System of Interstate and Defense Highways was completed to full standards, that 303.7 miles of the 948 miles of the system allocated to the State was open to traffic, and that 58 miles was under construction. Under the Federal-Aid Pri-

[8] Bureau of Public Roads. Quarterly Report on the Federal-Aid Highway Program, Dec. 31, 1962. Press Release BPR 63–10, Feb. 10, 1963.

TABLE 14.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Construction:				
Building	1,645	$1,827	1,945	$2,150
Paving	447	319	375	294
Fill	12	5	25	14
Other	28	30	16	13
Industrial:				
Blast	(1)	(1)	(1)	(1)
Engine	(1)	(1)	(1)	(1)
Filtration	5	54	(1)	(1)
Oil (hydrofrac)			(1)	(1)
Other	16	49	32	126
Ground: Foundry	13	15		
Total	2,166	2,299	2,393	2,597
Gravel:				
Construction:				
Building	2,886	3,699	3,363	4,435
Paving	4,041	3,393	4,519	4,327
Railroad ballast	2	5	(1)	(1)
Fill	138	86	107	82
Other	57	126	84	165
Miscellaneous	93	112	184	179
Total	7,217	7,421	8,257	9,188
Total sand and gravel	9,383	9,720	10,650	11,785
Government-and-contractor operations:				
Sand:				
Building	25	40	37	40
Paving	122	104	175	92
Fill	8	4	78	52
Other	5	5		
Total	160	153	290	184
Gravel:				
Building	88	90	227	198
Paving	8,420	6,842	7,861	6,550
Fill	309	141	285	209
Total	8,817	7,073	8,373	6,957
Total sand and gravel	8,977	7,226	8,663	7,141
All operations:				
Sand	2,326	2,452	2,683	2,781
Gravel	16,034	14,494	16,630	16,145
Grand total	18,360	16,946	19,313	18,926

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

mary and Secondary Highway Systems, 341.3 miles was completed and 133.2 miles was under construction. County and municipal governments continued constructing, maintaining, and repairing county and city highways and streets.

The Colorado Department of Highways reported that 107 awards were made during 1962 for constructing 621 miles of all types of highways at an aggregate cost of $54.1 million. Of these contracts, 13 exceeded $1 million. Major contracts included a bypass on U.S. Interstate Highway No. 25 at Walsenburg at an estimated cost of $3.4 million and improvement of U.S. Interstate Highway No. 25 in Pueblo County at an estimated cost of $2.6 million. Much progress

was made on the elevated highway on U.S. Interstate Highway No. 70 through Denver. Preliminary work was started on the Straight Creek Tunnel under the Continental Divide on U.S. Interstate Highway No. 70.

Stone.—Although the value of output increased 6 percent, total production of all types of stone was 4 percent below that of 1961. Crushed and dimension stone of several varieties—granite, limestone, marble, sandstone, and miscellaneous stone—was produced for many uses. Crushed limestone, representing 80 percent of the total stone output, was used principally for producing cement and lime and as a flux in steelmaking. Substantial quantities of all varieties of stone, except marble, were used for riprap and as an aggregate in concrete in building and highway construction.

TABLE 15.—Stone production in 1962, by counties

County	Short tons	Value	County	Short tons	Value
Adams	3,289	$16,569	Las Animas	7,637	$63,002
Arapahoe	6,516	31,640	Logan	1,844	7,556
Archuleta	393	1,617	Mesa	3,864	46,201
Boulder	8,767	90,357	Montezuma	12,190	73,080
Chaffee	174,759	427,846	Otero	657	5,254
Conejos	161	787	Park	2,670	21,053
Costilla	2,382	15,678	Phillips	7,518	17,626
Douglas	1,091	5,754	Pitkin	1,975	3,486
El Paso	(1)	(1)	Prowers	20	200
Fremont	865,830	1,782,426	Rio Blanco	509	4,072
Garfield	(1)	(1)	Routt	613	3,380
Grand	1,350	3,150	Summit	2,134	8,687
Gunnison	(1)	(1)	Teller	7,964	57,277
Jefferson	30,421	152,784	Washington	777	5,084
Kiowa	5,617	43,906	Weld	4,715	24,333
La Plata	(1)	(1)	Undistributed	309,517	642,022
Larimer	887,531	2,042,485	Total	2,352,711	5,597,312

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 16.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1958	10,837	$82,060	----	----	2,058	$186,012	2,701,750	$4,004,500
1959	136,439	229,460	(1)	(1)	(1)	(1)	2,482,700	4,344,000
1960	145,944	532,041	16,400	$25,700	4,075	124,026	2,123,194	3,484,757
1961	10,528	145,988	----	----	9,350	75,171	2,221,902	4,255,761
1962	20,872	161,315	----	----	9,094	79,960	2,164,513	4,395,440

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1958	37,641	$342,412	177,984	$328,063	2,930,270	$4,943,047
1959	43,381	294,015	161,149	669,043	2,823,669	5,536,518
1960	61,371	298,447	90,952	185,809	2,441,936	4,650,780
1961	52,281	427,356	157,229	396,288	2,451,290	5,300,564
1962	67,378	493,597	90,854	467,000	2,352,711	5,597,312

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

TABLE 17.—Stone sold or used by producers, by uses

Use		1961		1962	
		Quantity	Value	Quantity	Value
Dimension stone:					
Rough construction and rubble	short tons	7,095	$106,033	11,866	$121,302
Rough architectural	cubic feet	80,439	86,886	[2] 81,203	88,747
Dressed architectural	do.			[3] 31,234	63,121
Rough monumental	do.	[4] 8,852	21,531	[5] 7,965	11,947
Dressed monumental	do.	[6] 11,908	114,784	[7]	[7]
Flagging	do.	[8] 44,971	38,078	[9] 31,652	31,311
Other	do.			[10] 5,300	105,300
Total (approximate, short tons)		18,941	367,312	24,430	421,728
Crushed and broken stone:					
Riprap	short tons	29,819	92,308	55,750	148,372
Metallurgical	do.	476,293	1,037,718	317,131	677,076
Concrete and roadstone	do.	272,984	571,271	302,072	774,390
Chemical	do.	[7]	[7]		
Other	do.	[11] 1,653,253	[11] 3,231,955	[12] 1,653,328	[12] 3,575,746
Total	do.	2,432,349	4,933,252	2,328,281	5,175,584
Total stone (approximate, short tons)		2,451,290	5,300,564	2,352,711	5,597,312

[1] Approximately 6,613 short tons.
[2] Approximately 6,563 short tons.
[3] Approximately 2,438 short tons.
[4] Approximately 740 short tons.
[5] Approximately 669 short tons.
[6] Approximately 977 short tons.
[7] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[8] Approximately 3,516 short tons.
[9] Approximately 2,469 short tons.
[10] Approximately 425 short tons.
[11] Includes stone used in agriculture, cement, chemicals, coal dust, driveways, erosion control, feed supplement, filler (asphalt, rubber, and other), landscaping, lime, marble whiting, marker, ornamental aggregate, plaster sand, poultry grit, roofing chips, stucco, terrazzo, and walks.
[12] Includes stone used in cement, coal dust, erosion control, exposed aggregate, feed, filters, landscaping, lime, markers, ornamental aggregate, plastics, poultry grit, precasting, roofing granules, and terrazzo.

Lyons sandstone was mined in Boulder and Larimer Counties for building construction. Use of the pink to red quartzite sandstone as an exterior finish on the buildings on the Boulder campus of the University of Colorado was continued. Increased production resulted from an extensive building program. The university produced the stone required in 1962 at the Ingersoll quarry in Left Hand Canyon northwest of Boulder. Output in 1962 was for an addition to the Norlin Library and the Charles W. Kittredge residence hall complex to accommodate 1,000 students. Completion of the buildings was scheduled for September 1964.

Crushed sandstone was used as a refractory, in producing cement, and for riprap, concrete aggregate, and numerous landscaping and decorative purposes. Miscellaneous stone, produced in 28 counties almost entirely by contractors for the State highway department, was used in constructing the Interstate and State highway systems.

Vermiculite.—Crude vermiculite was produced in Jackson County for processing at a plant in Kansas. Crude vermiculite from deposits in Montana was exfoliated at a plant in Denver. The exfoliated product was used as loose fill insulation and as an aggregate in acoustical plasters.

REVIEW BY COUNTIES

Only those counties with significant production or activity in the mineral industry are discussed; see table 18 for additional details.

Adams.—Combined production value of sand and gravel and petroleum represented 95 percent of the total value of mineral output. Adams County sand and gravel production, 9 percent above that of 1961, accounted for 19 percent of the total for the State. Output from 13 commercial producers and 3 Government-and-contractor operations was used for building and paving in the Denver Metropolitan area. Construction of office buildings, apartments, dwellings, and Federal and State highways required increasingly greater quantities of building materials.

Petroleum production, from 70 wells in 15 fields, was 33 percent below that of 1961. Of 12 development wells drilled, 3 were producers; 19 exploratory wells completed were failures. The natural gas plant at the Leader field was shut down in February; the quantity of natural gas liquids recovered declined 88 percent.

Byproduct gold and silver recovered from sand and gravel washing plants declined. The Great Western Sugar Co. produced lime for use in sugar refining. Crushed stone for highway construction was produced by contractors for the State highway department.

TABLE 18.—Value of mineral production in Colorado, by counties [1]

County	1961	1962 [2]	Minerals produced in 1962 in order of value
Adams	[3] $6,354,831	$5,649,310	Sand and gravel, petroleum, natural gas, lime, gold, stone, natural gas liquids, silver.
Alamosa	102,811	113,900	Sand and gravel.
Arapahoe	1,946,843	1,886,740	Sand and gravel, stone, clays.
Archuleta	372,366	274,917	Petroleum, sand and gravel, stone.
Baca	[3] 303,900	714,500	Petroleum, natural gas, sand and gravel.
Bent	[3] 36,805	28,600	Natural gas, petroleum, sand and gravel.
Boulder	1,916,536	1,863,995	Fluorspar, sand and gravel, lime, stone, clays, uranium ore, peat, petroleum, gem stones.
Chaffee	893,989	(4)	Stone, sand and gravel, feldspar, gem stones.
Cheyenne	9,800	73,900	Sand and gravel.
Clear Creek	114,078	101,671	Silver, sand and gravel, lead, zinc, gold, copper, gem stones.
Conejos	43,400	3,887	Sand and gravel, stone.
Costilla	(4)	(4)	Sand and gravel, pumice, stone.
Crowley	30,600	36,250	Lime, sand and gravel.
Custer	117,631	(4)	Sand and gravel, perlite, clays.
Delta	(4)	(4)	Coal, sand and gravel, lime.
Dolores	(4)	(4)	Pyrites, zinc, lead, sand and gravel, silver, copper, gold, gem stones.
Douglas	674,613	830,251	Sand and gravel, clays, stone, gem stones.
Eagle	7,842,867	8,567,019	Zinc, silver, lead, copper, gold, sand and gravel, pumice, gem stones.
Elbert	21,650	(4)	Clays, sand and gravel, gem stones.
El Paso	1,494,603	1,337,287	Sand and gravel, stone, lime, clays, coal, beryllium concentrate, gem stones.
Fremont	12,383,684	11,909,516	Cement, stone, coal, gypsum, uranium ore, clays, petroleum, sand and gravel, beryllium concentrate, gem stones.
Garfield	[3] 582,763	907,032	Sand and gravel, natural gas, stone, lime, coal.
Gilpin	40,898	23,899	Peat, gold, lead, silver, zinc, copper, gem stones.
Grand	171,057	52,981	Sand and gravel, stone, copper, gem stones.
Gunnison	1,654,372	1,524,348	Coal, sand and gravel, stone, gold, silver, lead, gem stones.
Hinsdale	(4)	34,300	Sand and gravel.
Huerfano	(4)	440,797	Coal, sand and gravel, clays, uranium ore, gem stones.
Jackson	[3] 1,907,522	1,662,350	Petroleum, natural gas, fluorspar, sand and gravel, vermiculite.
Jefferson	4,052,346	4,582,910	Sand and gravel, uranium ore, clays, stone, gold, gem stones, beryllium concentrate, silver.
Kiowa	165,200	227,306	Sand and gravel, stone, petroleum, natural gas.
Kit Carson	6,800	10,800	Sand and gravel.

See footnotes at end of table.

TABLE 18.—Value of mineral production in Colorado, by counties[1]—Continued

County	1961	1962[2]	Minerals produced in 1962 in order of value
Lake	$65,759,348	$46,940,156	Molybdenum, tungsten concentrate, sand and gravel, pyrites, lead, silver, tin, gold, copper, zinc, gem stones.
La Plata	[3] 6,878,640	6,739,200	Natural gas, natural gas liquids, sand and gravel, petroleum, coal, stone, gold, lead, silver, copper, gem stones, zinc.
Larimer	13,078,529	13,723,583	Cement, stone, sand and gravel, petroleum, lime, gypsum, mica (scrap), gem stones, beryllium concentrate.
Las Animas	7,920,825	6,768,234	Coal, sand and gravel, stone, clays, carbon dioxide.
Lincoln	110,000	89,000	Sand and gravel.
Logan	[3] 15,520,702	15,775,246	Petroleum, natural gas, natural gas liquids, sand and gravel, lime, stone, gem stones.
Mesa	[3] 5,784,368	5,102,539	Uranium ore, vanadium, coal, sand and gravel, natural gas, stone, clays, gem stones.
Mineral	1,422,006	1,393,881	Zinc, lead, silver, copper, sand and gravel, gold, gem stones.
Moffat	[3] 7,423,151	6,322,624	Petroleum, natural gas, uranium ore, coal, sand and gravel, gem stones.
Montezuma	[3] 811,457	1,974,308	Sand and gravel, petroleum, stone, natural gas, carbon dioxide.
Montrose	[3] 21,778,943	19,096,286	Uranium ore, vanadium, coal, sand and gravel, salt, natural gas.
Morgan	[3] 30,452,010	20,122,418	Petroleum, natural gas liquids, natural gas, sand and gravel, lime.
Otero	[4]	[4]	Lime, sand and gravel, stone, gem stones.
Ouray	4,799,517	3,814,123	Zinc, copper, lead, gold, silver, gem stones, sand and gravel.
Park	72,123	[4]	Beryllium concentrate, stone, sand and gravel, uranium ore, gem stones.
Phillips	17,700	381,126	Sand and gravel, stone.
Pitkin	5,107,472	[4]	Coal, sand and gravel, stone.
Prowers	248,000	100,500	Sand and gravel, natural gas, stone.
Pueblo	722,118	983,170	Sand and gravel, clays, lime, uranium ore, zinc, copper, lead, silver, gold.
Rio Blanco	[3] 58,958,148	58,110,472	Petroleum, natural gas liquids, natural gas, sand and gravel, coal, vanadium, uranium ore, stone.
Rio Grande	200	[4]	Sand and gravel, gem stones.
Routt	2,415,220	2,629,937	Coal, petroleum, sand and gravel, pumice, stone.
Saguache	1,401,794	[4]	Uranium ore, gem stones, sand and gravel.
San Juan	42,206	475,757	Zinc, lead, silver, copper, gold, sand and gravel, gem stones, iron ore.
San Miguel	[3] 10,787,485	10,762,586	Vanadium, uranium ore, zinc, copper, lead, gold, silver, iron ore, sand and gravel, gem stones.
Sedgwick	[3] 226,750	155,594	Natural gas, lime, sand and gravel, gem stones.
Summit	323,999	268,235	Sand and gravel, stone, gem stones, lead, silver, gold, zinc.
Teller	990,708	[4]	Gold, stone, peat, silver, gem stones.
Washington	[3] 28,760,457	27,570,584	Petroleum, natural gas liquids, natural gas, stone, sand and gravel.
Weld	[3] 8,610,639	9,573,843	Petroleum, coal, sand and gravel, natural gas, lime, natural gas liquids, stone, gem stones.
Yuma	224,200	115,600	Sand and gravel, petroleum.
Undistributed[5]	[3] 2,317,683	6,267,751	
Total	[3] 346,208,000	308,115,000	

[1] Denver County is not listed because no production was reported.
[2] Petroleum values are preliminary.
[3] Revised figure.
[4] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[5] Includes some sand and gravel, gem stones, and stone (1961) that cannot be assigned to specific counties and values indicated by footnote 4.

Alamosa.—Throughput from the Oriental Refining Co. 1,110-barrel-per-day refinery at Alamosa was 258,998 barrels of crude oil, a 7-percent decline compared with that of 1961. Sand and gravel was produced for constructing State and county highways.

Arapahoe.—The county ranked third in the State in output of sand and gravel, although production was 12 percent below that of 1961. Much of the output, produced at eight commercial plants and two Government-and-contractor operations, was used for building and highway construction in the Denver Metropolitan area.

Archuleta.—Petroleum production, from 33 wells in the Chroma and Price-Gramps fields, was 10 percent below that of 1961. Two exploratory wells were failures; one development well, a gas producer, was shut-in. Sand and gravel was produced by maintenance crews and contractors for the Federal Forest Service and the State highway department.

Baca.—Petroleum production, all from the six-well Flank field, a 1961 discovery, was sixfold that of 1961. Of 15 development wells completed during 1962 in the Flank field, 5 were oil wells and 6 were gas wells. Natural gas production from the Greenwood and Walsh fields, the latter a 1961 discovery, was 62 percent above that of 1961. Sand and gravel was produced for the State highway department.

Bent.—Petroleum and natural gas were produced from the Bent's Fort and Lubers fields. Two exploratory wells were failures; three development wells completed were gas producers.

Boulder.—Output of nonmetallics accounted for virtually all ($1.8 million) of the value of mineral production in the county ($1.9 million). General Chemical, at the Burlington fluorspar mine, had a value of output larger than any other in the county. Crude ore from the mine was processed at the company-owned mill at Valmont. Sand and gravel production, reported from three commercial plants and two Government-and-contractor operations, was 11 percent above that of 1961. Dimension sandstone for use in buildings and for flagging was produced at nine quarries. At the Ingersoll quarry, the University of Colorado produced building stone for use in constructing the Kittredge residence hall complex and the addition to the Norlin Library on the Boulder campus. Lime production by The Great Western Sugar Co. for use in refining sugar was 13 percent above that of 1961. Fire clay and miscellaneous clay were produced at three pits for manufacturing building brick and heavy clay products. Colorado Brick Co. operated its plant at Valmont.

No production was reported for gold, silver, copper, or lead; uranium ore production, less than 1,000 tons, all from the Fair Day mine operated by Modern Minerals, Inc., and Vitro Chemical Co., was 93 percent below that of 1961. Petroleum was produced from the five-well Boulder field. Peat production for use as a soil conditioner and as a vehicle for organic fertilizers was more than double that of the previous year.

Chaffee.—Mineral production was limited to dimension and crushed granite; crushed limestone, sandstone, and miscellaneous stone; sand and gravel; and feldspar. Stone production, although 39 percent below that of 1961, continued to be the major mineral product. Dressed granite for monuments and crushed granite for use as poultry grit was produced by Colorado Granite Co. and Colorado Granite Grit Corp. CF&I produced crushed limestone at its Monarch quarry for use as flux and for producing lime. Crushed sandstone output by Ralph Pierce was used for producing cement; crushed miscellaneous stone produced by contractors was used by the State highway department in constructing highways. Building sand and gravel was produced by Hart Rok Redi Mixt Concrete, and paving gravel was produced for constructing State and county highways. Feldspar output, produced by M. & S., Inc., at the Homestake mine and ground by Western Feldspar Milling Co. at Salida for use in manufacturing

glass at plants in Oklahoma and Texas, was 32 percent below that of 1961. Gem-stone materials were collected by individuals, gem societies, and gem shops.

Clear Creek.—The total value of mineral production was 11 percent below that of 1961. Silver output was more than fourfold and zinc nearly threefold that of 1961. Copper output remained the same. Output of gold and lead declined 28 percent and 35 percent, respectively.

Increased interest in long-closed mines was evidenced by exploration activities in the Empire (Upper Union) District northwest of Empire by Kerr-McGee Oil Industries, Inc., and at various mines throughout the county by individuals. Of particular significance was the increased production of silver, most of which came from the Cascade mine operated by Humphreys Engineering Co. and the Franklin mine operated by Franklin & Silver Age Mining Co. Ore from the Cascade mine was processed at the Silver Spruce mill in Idaho Springs. All of the copper and zinc and most of the lead production also came from these mines. Other operations at mines included activities at the Fairmont by Silver Wreath Mines Co., Humbolt by Richard Mackey, Johnny Bull by Globe Hill Mining Co., Princess of India by Superior Acceptance Corp., and Santa Fe by Lancy & Lubliner.

Climax Molybdenum Co. made an extensive survey and did some exploratory work at the Urad mine, west of Empire. During World War I this mine produced substantial quantities of molybdenum. Booth Sand and Gravel Co., Silver Plume, produced building sand and gravel; paving gravel was produced for the State highway department. Preliminary work was begun on constructing the Straight Creek Tunnel, a part of U.S. Interstate Highway No. 70, through the Continental Divide. Mineral specimens were collected by individuals and gem societies.

Custer.—Persolite Products, Inc., produced crude perlite at the Rosita quarry for processing at its plant at Florence. Output was 25 percent above that of 1961. Clay production at the Lawson Place pit by H. K. Porter Co., Inc., for use in manufacturing refractories declined as did the output of sand and gravel for use by the State highway department.

Delta.—Coal production, from six mines, was 15 percent above that of 1961. Major producing mines were the King, Green Valley No. 2, and Emmons mines. Delta Sand and Gravel Co. produced building and paving sand and gravel; State and county highway department crews produced paving gravel. Lime was produced by Holly Sugar Co. for use in refining sugar.

Denver.—Oil refineries in the Denver Metropolitan area—four in the city and county of Denver and one in Adams County at Derby—were operated throughout the year. Combined throughput was 12.6 million barrels, a slight increase over that of 1961. Although no mineral-commodity production was reported within Denver County, much of the sand and gravel and fire and miscellaneous clays produced in the Denver Metropolitan area was used in construction projects and at the various plants and factories within Denver County.

Asarco operated its Globe plant for recovering cadmium and other metals and compounds from flue dust, dross, and other material

shipped from Company and other smelters andplants. General Chemical produced sulfuric acid at its plant in Denver, largely from pyrites produced in Lake County.

Dolores.—Rico Argentine Mining Co. operated the Rico Argentine mine and mill in the Pioneer mining district. In its annual report to stockholders, the company stated that 16,313 tons of lead-zinc ore were mined and milled during the fiscal year ending June 30, 1962; the mill operated at about 45 percent of capacity. Concentrates recovered contained 58 ounces of gold, 48,583 ounces of silver, 1,048 tons of lead, and 1,143 tons of zinc. Development work consisted of 874 feet of drifts and crosscuts and 567 feet of raises. The work was equally divided between the Argentine and Mountain Springs areas. Pyrite was mined in the Mountain Springs area and used at the company-owned Ramco acid plant north of Rico for manufacturing sulfuric acid which was sold to various uranium mills in southwestern Colorado. A small quantity of gold ore was produced at the St. Louis mine by Expectation Mining Co. Paving gravel was produced by a contractor for the Federal Forest Service, and paving sand and gravel was produced by Dolores County highway crews. Quartz crystals and mineral specimens were collected. Total value of mineral output was 31 percent below that of 1961.

Douglas.—The value of each of the minerals produced—sand and gravel, clays, stone, and gem stones—increased over that of 1961. Denver Brick & Pipe Co. and Robinson Brick & Tile Co. produced fire and miscellaneous clays in Douglas County for manufacturing building brick, tile, and heavy clay products at plants in Denver. Building sand and building and paving gravel were produced by Hall Sand & Gravel, Inc., and Pre Mix, Inc. Paving gravel was produced by contractors for constructing State and county highways. Helmer Bros. produced crushed limestone for use as a flux. Carl Gross produced rough sandstone for building, and L. N. & F. A. Johnson produced rough construction stone. Individuals collected various types of gem material in the Parker and Devil's Head areas.

Eagle.—Mineral production of gold, silver, copper, lead, zinc, sand and gravel, and pumice was valued at $8.6 million, a 9-percent increase over that of 1961, resulting largely from increased output of silver, copper, and zinc at the Eagle mine operated by The New Jersey Zinc Co. The county was ranked first in the State in the production of silver and zinc and third in the production of copper and lead. Zemlock & Son, Sand & Gravel produced building sand and gravel. Paving gravel was produced at Government-and-contractor operations for constructing State and county highways. Lava Products, Inc., and Roaring Fork Pumice Co. produced volcanic cinders for use as a concrete aggregate. Gem stone material and mineral specimens were collected in the vicinity of Gilman by individuals and gem shops.

El Paso.—Principal mineral activity was in sand and gravel followed by stone, lime, clays, and coal. The total value of all minerals produced in the county was 11 percent below that of 1961. Building and paving sand and gravel, fill, and miscellaneous gravel were produced by seven commercial operators. Principal producers were Broderick & Gibbons, Inc.; Rocky Mountain Oil Paving, Inc.; and Transmix Concrete Co. Paving sand and gravel and building gravel were produced at Government-and-contractor operations for constructing State

and county highways and municipal streets. Castle Concrete Co. produced crushed limestone for use as riprap, concrete aggregate, and ornamental purposes. Colorado Lime Co. produced crushed limestone for producing lime. Wm. Eskeldson produced crushed sandstone for refractory and foundry uses. Crushed stone, produced by contractors, was used in constructing State highways. Robinson Brick & Tile Co. produced fire clay at the Apache No. 8 mine for use in manufacturing building brick and tile at its plant in Denver. Standard Fire Brick Co. produced fire clay at the Husted mine for manufacturing firebrick and fire clay refractories. National Clay Products Co. produced miscellaneous clay for manufacturing heavy clay products. Coal production was by the Franceville Coal Co. at its Franceville strip mine. Mineral specimens were collected in the vicinity of Cookstove Mountain.

Fremont.—Mineral-production value was 4 percent below that of 1961. Gains in the value of coal, clays, and gypsum output were not sufficient to counterbalance losses in other commodities. Coal production, all from 19 underground and 3 strip mines, was 7 percent above that of 1961. Major production was from the Pioneer Canyon No. 2, Canon Black Diamond, Vento, Canon Monarch No. 4, and Cedar Canon underground mines and the Beer strip mine. Fire clay, produced by H. K. Porter Co., Inc., Refractories Division, at the Flint and Salt Canyon mines and Irvin Clay Co. at the Irvin mine, was used for manufacturing firebrick and refractory products. George O. Stroup mined fire clay at the Phantom Canyon and 8-Mile mines for use in manufacturing building brick, tile, and heavy clay products. Bentonite, produced by Glen Lamberg & Sons at the Triangle-Lamberg mine, was used as a sealer in stock ponds and irrigation ditches. Gypsum, mined by Pabco Building Materials Division, Fibreboard Paper Products Corp., was calcined for manufacturing gypsum board products and was used as a retarder in portland cement. K & H Soil Conditioning Co. and U.S. Soil Conditioning Co. produced crude gypsum for agricultural use.

Shipments of portland and masonry cements from the Portland plant of Ideal Cement Co. were slightly below those of 1961. Denver & Rio Grande Western Railroad Co. produced crushed granite at the Akin, Echo, and Princeton quarries for use as riprap. Colonna Co. of Colorado, Inc., produced crushed granite at the Pink Granite quarry for use as an ornamental aggregate. Crushed limestone, produced by CF&I, Colorado Limestone Co., and Frank H. Norberg Co., was used as a flux. Production by the Norberg Co. also was used for concrete aggregate and for producing lime. Output from the Portland quarry by Ideal Cement Co. was used for producing cement. Colonna Co. of Colorado, Inc., produced crushed marble at the Canon City and Salida quarries for use in terrazzo; Cowan Bros. produced rough building marble at the Travertine quarry. Crushed miscellaneous stone production by Braly & Gresham Stone Co. was used as an aggregate precasting. Building sand and gravel was produced by Sing's Sand & Gravel Co. Building sand and gravel was produced by the Colorado State Penitentiary for building construction; contractors and maintenance crews produced paving sand and gravel for contructing State, county, and municipal highways.

Petroleum production from the Florence field, the second oldest oilfield in the Nation, was 4 percent above that of 1961. One successful development well was completed; at yearend the field had 31 producing wells. Beryllium concentrate (beryl) production—from the Black Hawk and Devil's Hole mines by Ralph J. Pierce, the Mica Lode mine by Lockhart & Sons, and the No. 1 Kenneth mine by Kenneth Hodgson—was three times the county total in 1961. Uranium ore production declined sharply because of the exhaustion of minable ores, cessation of operations by Gunnison Mining Co. upon closing of its processing plant at Gunnison early in April, and adjustment of the operating rate at the Cotter Corp. processing plant at Canon City following the establishment of the 1962–66 schedule of uranium oxide concentrate procurement program by AEC on April 1. Production of uranium ore at the 12 operations in the county was 76 percent below the total output in 1961. A variety of gem materials and mineral specimens was collected by individuals and gem societies.

Garfield.—Coal production from the active mines in the county declined 34 percent compared with the total output in 1961. Natural gas output, all from 20 wells in 8 fields, increased slightly. Three development wells completed were gas producers. One of the two development wells drilled in the Rulison field was a 4-mile extension of the producing zone. The third successful development well was in the Prairie Canyon field. Production of sand and gravel increased 37-fold over that of the previous year because of increased road construction. Output was by Domenic Leone Construction Co. and by contractors and crews of the State highway department for construction on U.S. Interstate Highway No. 70. Crushed limestone was produced by Frank H. Norberg Co. and Basic Chemical Corp. for use as a concrete aggregate and for producing lime. Basic Chemical Corp. also prepared ground limestone for use as rock dust in coal mines and produced hydrated lime for building, agricultural, and chemical use. Union Carbide Nuclear Co. operated its 1,000-ton-per-day uranium processing plant at Rifle. Uranium and vanadium oxide were recovered from ores produced in Colorado and adjoining States. An adjustment of the operating rate was necessary in April when the 1962–66 program of procurement of uranium oxide by AEC became effective.

Gilpin.—Gold, silver, copper, lead, and zinc production was from the Glory Hole lode mine operated by Glory Hole, Inc.; the Carroll lode mine operated by Klame Corp.; and the Bobtail and Couch placer mines operated by R. F. Zacker and Stancil Couch, respectively. Some activity at nonproducing mines was reported, but no production resulted from the work and no plans of reopening the mines were announced. OME executed a contract with Nye Metals, Inc., of Black Hawk to explore for molybdenum mineralization. Under the contract two mines were to be explored by drifting and diamond drilling. Government participation in the contract was 50 percent of the estimated cost of $76,650. Peat production for use as a soil conditioner and as a vehicle for organic fertilizer was below that of 1961.

Gunnison.—Coal production from the eight underground mines in the county was 25 percent below the total output in 1961. Major producers were Columbia-Geneva Steel Division, United States Steel Corp., at the Somerset mine; Bear Coal Co. at the Bear mine; Cham-

pion Coal Mining Co. at the Hawk's Nest mine; and Nu-Mine Coal Co. at the Nu-Mine No. 2. Most of the production was used for manufacturing coke in Utah. Building and fill sand and paving gravel were produced by Gunnison Ready Mix Concrete Co., Inc.; building and paving gravel were produced by contractors for the Bureau of Reclamation and the State highway department for use in construction work and relocation of U.S. Highway No. 50 as part of the Curecanti water-storage and diversion project on the Gunnison River. Industrial Minerals Corp. produced dimension marble for building purposes and crushed marble for use as roofing granules, landscaping, and similar purposes. The total value of production of gold, silver, and lead at the Custer mine was above that of 1961. The uranium processing plant of Gunnison Mining Co., a subsidiary of Kerr-McGee Oil Industries, Inc., at Gunnison was closed early in April because of the exhaustion of minable uranium ores at the company-owned mines in Saguache County. Independent shippers of uranium ores could not provide crude ore in sufficient quantity to warrant continuing operations. The contract between Gunnison Mining Co. and AEC which was to terminate on December 31, 1962, for purchasing uranium oxide concentrate, was relinquished. OME executed a contract with Gaddis Mining Co. to explore a gold-silver-copper-lead-zinc deposit in Taylor Park. The work, to consist of drilling from the surface, was estimated to cost $15,460 of which the Government would provide 50 percent.

Huerfano.—Coal production from six mines was 7 percent below the total for 1961. Major production was by Delcarbon Coal Co. at the Calumet No. 2 mine and Red Ash Coal Co. at the Maitland No. 2 mine. Fire clay production by Standard Fire Brick Co. was used for manufacturing building brick, tile, heavy clay products, and refractories. Paving gravel was produced by Domenic Leone Construction Co. and by contractors and crews for the State highway department for constructing the Walsenburg bypass on U.S. Interstate Highway No. 25. Uranium ore produced at the Stumbling Stud mine was processed at the Cotter Corp. plant at Canon City.

Jackson.—Petroleum and natural gas production, from 47 wells in 3 fields, was below the county total for 1961. Three exploratory wells drilled were failures; of 11 development wells completed, 7 were oil wells and 1 was a gas well. Crude fluorspar was produced by Mahoning Mining Division, Ozark-Mahoning Co. Crude vermiculite was produced by Vonolite Products, Inc., for processing at a plant in Kansas. Paving gravel was produced by and for the Federal Forest Service, State highway department, and the Jackson County Highway Department.

Jefferson.—Sand and gravel, uranium ore, and fire and miscellaneous clays were the principal mineral commodities produced. Sand and gravel production by nine commercial operators and at one Government-and-contractor operation was 22 percent above the total for 1961. Much of the production was used in the Denver Metropolitan area for building construction and on Federal, State, and county highways. Byproduct gold and silver were recovered at some of the sand and gravel preparation plants. Production of uranium ore, from five mines, was 40 percent below that of 1961; all was processed at the Cotter Corp. plant at Canon City. Major production was from the Schwartzwalder mine operated by Denver Golden Corp. and from the

Ascension mine operated by Yellow Queen Uranium Co. The 1962–66 AEC schedule of procurement of uranium oxide concentrate necessitated curtailing throughput at the Canon City plant.

Fire clay and miscellaneous clay, from 15 active mines, primarily were used for manufacturing building brick, tile, heavy clay products, and lightweight aggregate at plants in Denver and Jefferson Counties. A small quantity of the fire clay produced was used for manufacturing refractories. L. N. & F. A. Johnson produced dimension granite for building use. Rocky Mountain Aggregates, Inc., produced rough construction stone and crushed stone for manufacturing precast concrete forms. Contractors and State highway crews produced for the State highway department crushed stone for constructing highways. Gem shops, gem societies, and individuals collected gem-stone material in the vicinity of Sedalia and Golden.

Kiowa.—Petroleum production was from the two-well Brandon field, and natural gas was from the six-well McClave field; output from the county was slightly above that of 1961. Three exploratory wells were failures. Of three development wells completed, one was an oil well. Contractors and State highway crews produced sand and gravel and crushed stone for the State highway department for highway construction.

Lake.—The 29-percent decline in value of mineral production resulted from a strike which began on July 19 and continued throughout the year at the Climax mine and mill of Climax Molybdenum Co. On October 29, supervisory personnel resumed operations to prevent damage from freezing weather which could have seriously hampered resumption of full-scale operations until spring 1963. Company officials reported that by selective mining of higher grade ores and deferment of advance preparation work, output reached 75 percent of capacity within a short time after operations were resumed by supervisory personnel. Negotiations for settlement continued throughout the year, and at yearend a settlement apparently was close. According to the Amax report to shareholders, production of molybdenum was 32.7 million pounds, 32 percent less than the 48.1 million pounds produced in 1961. Mine development was continued throughout the year, although at a much reduced rate during the strike. The program was directed toward developing a third level below the two currently operating levels and toward developing the contiguous Ceresco Ridge ore zone. An additional milling unit was being constructed to improve recoveries and to increase the daily tonnage rate of processing. Completion of the development of the Ceresco Ridge ore zone and mining at a daily rate of 5,000 tons were scheduled for 1965. Research in the recovery of molybdenum from nonsulfide ore was continued. Byproduct tin, tungsten, and pyrite also were recovered at the Climax mine. According to the company annual report, production of tungsten totaled 878,000 pounds, nearly 40 percent below the 1961 output of 1,433,000. Sales of tungsten were slightly in excess of production, but average unit prices were lower than in the previous year because of substantial sales by the Sino-Soviet bloc in the free world markets. Tin concentrates produced by the company and sold to Fred P. Lenway & Co., Inc., of San Francisco, Calif., were upgraded at a mill near Boulder. Shipments of pyrite to the General Chemical plant at Denver for manufacturing sulfuric acid were 42 percent above

those of 1961. Aoh Jacobson and Walter Jacobson Mining Co. recovered gold, silver, copper, lead, and zinc through a cleanup of the Arkansas Valley Smelter site at Leadville. Closing and dismantling the smelter began in 1961. The quantities recovered from the same source were substantially higher than in 1961. Building sand and gravel was produced by C. Ryan & Son, and crews of the State highway department produced paving gravel. Mineral societies, individuals, and mineral dealers collected mineral specimens near Leadville.

La Plata.—Coal production, from nine underground mines, was slightly above the total output in 1961. Major producers were Victory Coal Co. at the Victory No. 3 mine and King Coal Co. at the King Coal mine. Natural gas and petroleum production came from 375 wells; outputs were 6 and 36 percent, respectively, above the figures for 1961. Dry natural gas output was from the Ignacio-Blanco field producing from the Mesaverde, Dakota-Morrison, and Fruitland formations, and from the Alkali Gulch field producing from the Paradox formation. Petroleum and oil well gas output, which was relatively small, was from the Mancos and Gallup formations of the Red Mesa field. Six exploratory wells drilled resulted in one new oilfield and new gas producing horizons in the Ignacio-Blanco and Alkali Gulch fields. Of 55 development wells completed, 7 were oil and 44 were gas producers. Most of the gas wells were in the Ignacio-Blanco field. El Paso Natural Gas Co. operated its San Juan natural gas processing plant at Ignacio. Gas intake at the plant was 20.8 billion cubic feet. The plant functioned primarily as a pressure maintenance station, and dry natural gas from the company wells in the Ignacio-Blanco field was passed through the plant compressors without processing. Natural gas liquids were recovered from the oil well gas treated.

A small quantity of gold ore was produced at the Jenny Lind and Western mine by Steward Bros., and a cleanup of the Root & Norton assay office at Durango resulted in the recovery of gold, silver, copper, lead, and zinc. Vanadium Corporation of America (VCA) operated its uranium processing plant at Durango throughout the year. Crude ore was from company-owned mines and from independent operators on the Colorado Plateau. Vanadium oxide contained in some uranium ores also was recovered at the plant. Building sand and building and paving gravel were produced by Animas Valley Sand & Gravel, Inc.; Burnett Construction Co.; and C. B. Johnson Gravel Products Co. Contractors produced paving gravel for the State highway department. VCA produced crushed limestone for use as a flux, and contractors produced crushed miscellaneous stone for the State highway department for use in constructing highways.

Larimer.—Portland cement, stone, sand and gravel, and petroleum were the principal minerals produced in 1962. Ideal Cement Co. mined limestone for producing portland cement at its Boettcher plant at La Porte. The total for the shipments of cement was 6 percent above that of 1961. Frank H. Norberg Co. and Pinon Grove Lime Co. produced crushed limestone for producing lime. The Great Western Sugar Co. produced lime for use in refining sugar. Dimension sandstone produced at 13 quarries was used as rough and dressed building stone and for flagging. The red and pink Lyons sandstone was widely

used for both public and private buildings. Major producers were Colorado Stone Co. and Berthoud Pink Stone Co. Crushed and broken stone from some of the quarries was used as riprap by the Bureau of Reclamation on South Platte River projects. Contractors produced crushed miscellaneous stone for the State highway department for constructing highways. Petroleum production for the county, all from 36 wells in 3 fields in 1962, was slightly above that of 1961. Major production was from the Ft. Collins and Wellington fields. Two exploratory wells were completed, of which one was the discovery of a new producing horizon (Dakota sandstone) in the Loveland field. Building sand and gravel and paving gravel were produced by Loveland Ready Mix Concrete, Inc.; Roland Weitzel Ready Mix Concrete; and Sterling Sand & Gravel Co. Building sand was produced by the Bureau of Reclamation. Building gravel was produced by crews of the Larimer County Highway Department and by contractors for the State highway department. Crude gypsum was produced by E. W. Munroe and United States Gypsum Co. Part of the scrap mica produced by Jolex Mica Co., Inc., at the Langston mine was ground for use in well drilling. A small quantity of beryllium concentrate (beryl) was produced at the Crystal Snow mine by Holman & Bertha Snider.

Las Animas.—Coal production from 10 underground mines was 14 percent below that of 1961. Output from the Allen mine operated by CF&I, the major producer, was used by the corporation for manufacturing coke at its steel plant in Pueblo. Fire clay and miscellaneous clay were produced by Empire Clay Products Inc.; fire clay was produced by Harbison-Walker Refractories Co. and Scott Mining Co. All of the miscellaneous clay and a part of the fire clay produced were used for manufacturing building brick, tile, and heavy clay products. The bulk of the fire clay produced was used for manufacturing refractories at plants in Pueblo. Carbon dioxide produced at the Nina View field was transported by pipeline to a plant in Bent County for conversion into dry ice and liquid carbon dioxide. Gravel for building, paving, fills, and other uses was produced by Graham Construction Co. Maintenance crews and contractors produced paving sand and gravel for use on State and county highways. Crushed stone for use by the State highway department in road construction was produced by contractors.

Logan.—Petroleum production from 403 wells was 4 percent above that of 1961. The county was ranked fourth in the State in petroleum output. Drilling of 42 exploratory wells resulted in 1 oil and 2 gas discoveries; of 32 development wells completed, 14 were oil wells. Oil well gas was processed at six plants. Four plants were operated by Associated Oil & Gas Co., successor to N. C. Ginther at the Lewis Creek, Little Hoot, Padroni, and Yenter fields; one plant was operated by Kansas-Nebraska Natural Gas Co. at the Mount Hope-Walker field, which was idle in November and December; and one new plant was operated by Sunray DX Oil Co. at the Minto field, where operations began in December. Throughput at the six plants was 8.4 billion cubic feet of oil well gas, with the recovery of 20 million gallons of natural gas liquids. Residual gas from the plants was marketed through pipelines. Building sand and building and paving gravel were produced by Sterling Ready Mix Concrete Co., and maintenance

crews produced paving gravel for the State highway department and fill sand and paving gravel for the county highway department. Contractors produced crushed stone for the State highway department. The Great Western Sugar Co. produced lime for use in sugar refining.

Mesa.—Uranium production from 50 operations was 4 percent below that of 1961 when output was from 74 operations. Major producers were Beaver Mesa Joint Venture; Climax Uranium Co., Climax Division, American Metal Climax, Inc.; Shipman Mining & Exploration Co.; Argo Mining Co.; Foster & Sons; and E. E. Lewis, Inc. Adjustments in production rates were made after April 1 when the 1962–66 program of procurement of uranium oxide concentrate by AEC became effective. Climax Uranium Co. operated its processing plant at Grand Junction throughout the year. Crude ore was from company-owned mines and from independent producers. Shipments of crude ore were made to plants at Durango, Rifle, Uravan, and Mexican Hat (Utah). Vanadium oxide contained in some uranium ores was recovered at mills with vanadium recovery units at Durango, Grand Junction, Rifle, and Uravan. Coal production from six mines was 9 percent below that of 1961. Major production was at the Cameo mine, operated by Kerr Coal Co., where the entire output was transported by conveyor belt to the PSC Cameo thermal power plant at the mine.

Junction Brick & Supply Co. produced miscellaneous clay for manufacturing building brick, tile, and heavy clay products. United Stone Products Co. produced crushed sandstone for use as exposed aggregate and dimension sandstone for use as rubble and dressed stone in building construction. Contractors for the State highway department produced crushed stone for use as riprap and as a concrete aggregate. Sand and gravel was produced by Fruita Ready Mix Sand & Gravel Co., Tilton Construction Co., United Sand and Gravel Co., and Whitewater Sand & Gravel Co. Paving gravel was produced by crews of the State highway department and paving and fill gravel by crews of the county highway department; paving gravel was produced by contractors for the State highway department and the Bureau of Public Roads. Dry natural gas production from 15 wells in 9 fields was 25 percent above that of 1961. Gas discoveries were in the southern part of the Piceance basin and 6 miles south of existing production at the Cameo field. Of 5 development wells completed, 2 were gas wells, 1 of which was a 2-mile extension to the east of the Cameo field.

Mineral.—Production of gold, silver, copper, and zinc was slightly lower than in 1961. Lead output, however, increased slightly. Production was from the Emperius (Amethyst and Commodore) mine operated by Emperius Mining Co. Paving and fill sand and gravel was produced by the county highway department for road construction. Gem societies and individuals collected agates and mineral specimens near Creede.

Moffat.—Uranium ore output from mines of Union Carbide Nuclear Co. near Maybell increased 11 percent over that of 1961. When open-pit operations became too deep for economic surface methods, underground operations were begun to extract ores that had been delineated by drilling in advance of the open-cut faces. The company operated its uranium processing plant at Maybell throughout

the year. Crude ores were from the company-owned mines in Moffat County and from mines in Wyoming. Coal production was from the Wise Hill strip mine and the Red Hill and Wise Hill No. 3 underground mines.

A loan of $15.6 million was granted to the Colorado Ute Electric Association by the Rural Electrification Administration in March for constructing a $31.3 million 150-megawatt thermal powerplant near Hayden. Contracts for construction of the plant and installation of equipment were awarded, and construction of the plant was scheduled to start in January 1963. Coal for the plant would be mined from deposits in the vicinity of Hayden. Petroleum and natural gas production from 118 wells in 19 fields declined 30 and 7 percent, respectively, from that of 1961. Of 21 exploratory wells completed, 2 were oil and 2 were gas discoveries. The most significant discovery of the year in western Colorado was the Williams Fork field, 4.5 miles northwest of the Moffat field. Nine development wells were completed, of which four were oil wells and two were gas wells. Sand and gravel production by Craig Sand & Gravel and by maintenance crews and contractors for the State and county highway departments was more than double that of 1961. John Block collected specimens of dinosaur bones and petrified wood; A. L. Cameron collected agate near Sunshine.

Montezuma.—Petroleum and oil well gas from 12 wells in 6 fields was more than double that of 1961. Major production was from the Flodine Park and Towaoc fields. Three exploratory wells drilled were failures, but of eight development wells completed, three were oil wells. The Ismay field in Utah was extended nearly 1 mile eastward into Montezuma County. Carbon dioxide from wells in the McElmo field was converted into dry ice by Colorado Carbonics Corp. at its plant at McElmo.

Gravel production by Nielsons, Inc., and sand and gravel production by contractors for the Federal Bureau of Public Roads and the State highway department was nearly three times as great as in 1961. Contractors also produced crushed stone for the State highway department.

Montrose.—The county continued to lead the State in the production of uranium ore; output, from 198 operations, represented 45 percent of the total production of crude ore, 52 percent of the contained uranium oxide, and 55 percent of the mine value of crude ore shipped. Union Carbide Nuclear Co., Hamilton Cromie, and VCA were the leading producers. Union Carbide Nuclear Co. operated its processing plant at Uravan throughout the year. Adjustments were made in operating rates to meet the 1962–66 AEC schedule of procurement of uranium oxide concentrate. At Uravan a sulfuric acid plant with a daily capacity of 125 tons was placed in operation in October using elemental sulfur from Texas and Wyoming; the plant provided acid for leaching uranium ores at the Uravan plant. VCA operated its uranium concentrator at Naturita and shipped the upgraded product to the corporation processing plant at Durango for further treatment. Significant quantities of vanadium oxide were recovered from many uranium ores processed at the Uravan and Durango plants. Vanadium oxide contained in uranium ores that were processed at plants at Grand Junction, Rifle, and Shiprock (N. Mex.) also was recovered.

Salt recovered from well brines by Union Carbide Nuclear Co. was used in processing uranium-vanadium ores at plants at Uravan and Rifle.

Coal production from the Navajo strip mine operated by Edna Coal Co. was 7 percent below that of 1961; the output was consumed at the Colorado-Ute Cooperative thermal powerplant at Nucla. Natural gas production from the one well in the Montrose Dome field was nearly double that of 1961. Two exploratory wells drilled were failures.

Sand and gravel production was 21 percent below that of 1961. Sand and gravel was produced by Braisers Bros. Construction Co. (building sand); C. E. Mills, contractor (paving and fill gravel, building sand); and Montrose Concrete Products Co. (building gravel). Maintenance crews and contractors produced paving gravel for the State highway department.

Morgan.—Petroleum production, from 276 wells, was 38 percent below that of 1961. Declining output at the Adena field by waterflooding accounted for much of the drop. The Adena field had produced in excess of 53 million barrels of crude oil. Other fields also declined in output. Of 37 exploratory wells drilled, 3 were oil and 2 were gas discoveries. With one exception, all of the discoveries were in the southeastern corner of the county in the Hunter, Jubilee, and Sentry fields. Development drilling joined the Sentry discovery with the Timpe field, a 1955 discovery. A gas discovery was made 1 mile south of the Bijou field in the northwestern part of the county. Development drilling of 35 wells resulted in 8 oil wells and 3 gas wells. Oil well gas was processed at four natural gas plants. Associated Oil & Gas Co., successor to N. C. Ginther, operated plants at the Bijou and Vallery fields; Natural Gas Producers, Inc., operated a plant at the Fort Morgan field; and Pure Oil Co. operated a plant at the Adena field. Throughput at the four plants was 9.6 billion cubic feet of gas, with the recovery of 1.1 million barrels of natural gas liquids.

Sand and gravel production was 14 percent above that of 1961. Sand and gravel was produced by Builders Aggregate Co.; Green Brothers, Inc.; and Jacob Dorn & Son, Inc. Maintenance crews and contractors produced paving gravel for the State highway department; maintenance crews produced paving gravel for the county highway department. The Great Western Sugar Co. produced lime for use in refining sugar at its plant at Fort Morgan.

Ouray.—Mineral output was almost entirely gold, silver, copper, lead, and zinc from four operations. The bulk of the production was from that part of the Idarado mine lying in Ouray County and the Camp Bird mine. The county was ranked second in the State in production of copper and lead and third in the production of gold, silver, and zinc. Crude ore from the Treasury Tunnel, part of the Idarado mine in Ouray County, was milled at the company-owned plant at Pandora in San Miguel County. Transportation was through connecting tunnels and vertical openings to the mill at Pandora. Operations at the Camp Bird mine were continued throughout the year. The rate of output was curtailed in the latter part of the year because of the low price of lead and zinc. Mining operations were almost entirely on the Discovery and Norman Spur shoots of the Camp Bird mine with some production from the Pierson mine. The Revenue group

of mines, consisting of 73 claims, was acquired on a long-term lease. Rehabilitation and development work on the group were planned. Access to the group was through the Revenue Tunnel, the portal of which is 7,000 feet northwest of the Camp Bird mill.

The 500-ton-per-day Camp Bird mill was operated on a one-shift basis except during March and April. Small shipments of gold, silver, copper, lead, and zinc were made from the third level of the Camp Bird mine by Egan Nordlander and from the Mineral Farm mine by M. W. Waldrum. OME executed a contract with Bimetallist Mining Co. to explore for gold and silver. The estimated cost of the work was $26,850 with 50-percent participation by the Government. Paving sand and gravel was produced by maintenance crews for the State highway department. A variety of mineral specimens was collected by gem shops from many mine dumps and mineral outcrops.

Park.—Beryllium ore production from the Boomer Lode mine and from the Hazel Marie mine was 6 percent below that of 1961. The ore contained beryl and bertrandite. Mincon completed its 100-ton-per-day beryllium concentrating plant near Lake George and began operations early in January. The mill processed low-grade ores and produced a concentrate containing 11.4 to 13.5 percent beryllium oxide. The concentrate was shipped to the company processing plant at Loveland where a high-purity beryllium oxide was recovered. Uranium ore produced at the Lucky Jim mine by Harding & Potter was shipped to the Cotter Corp. plant at Canon City for processing. Paving sand and gravel, produced by maintenance crews, and crushed stone, produced by contractors, were used by the State highway department for constructing highways. No production of gold, silver, and the base metals was reported during the year. Plans were announced for constructing the Progressive mill and smelter northwest of Fairplay. The plant, to be constructed as a joint community project, was to process all of the metallic ores mined in the Fairplay district. Numerous individuals, gem shops, and gem societies collected mineral specimens in the vicinity of Badger Flats, Hartsel, and Lake George.

Pitkin.—Coal production—by Mid-Continent Coal & Coke Co. at the Dutch Creek mine and by Thompson Creek Coal and Coke Corp. at the Thompson Creek Nos. 1, 2, and 3 mines—was 29 percent below that of 1961. Building and paving sand and paving gravel were produced by Hemann Sand and Gravel and Chas. M. Evans, contractor. Paving sand and gravel was produced by maintenance crews and paving gravel and crushed rock for riprap were produced by contractors for the State highway department. Morrison-Knudsen Co., Inc., contractor for Pitkin Iron Corp., continued stripping and developing operations at the corporation iron deposit southeast of Ashcroft. A conveyer was installed across the Roaring Fork River at Woody Creek to facilitate loading operations. No ore shipments were reported during the year.

Pueblo.—Fire clay produced by General Refractories Co., Harbison-Walker Refractories Co., and Standard Firebrick Co. was used for manufacturing clay refractories at plants in Peublo and at Lehi, Utah. Miscellaneous clay produced by Summit Pressed Brick & Tile Co. was used for manufacturing building brick, tile, and heavy clay products. Sand and gravel production by Broderick & Gibbons, Inc.;

Certified Concrete Co.; Fountain Sand & Gravel Co.; Graham Sand & Gravel Co.; Jess Hunter Motor Co.; and O Sand & Gravel Co. was used for building, paving, and fills. Prepared industrial sands for sand blasting, engine sand, filtration plants, and for fracturing oil wells also were produced. Crews of the State and county highway departments produced paving gravel.

Uranium ore from the Avery Ranch mine was processed by the Cotter Corp. at its plant at Canon City. CF&I completed installing a lime plant at its steel plant at Pueblo. The basic-oxygen steelmaking process, installed in 1960, required lime rather than limestone for fluxing. The new lime plant, a high-capacity vertical kiln, began operating in August. Limestone for the plant was from the corporation Monarch quarry on the east slope of Monarch Pass. Some experimental work of oxygen enrichment in blast furnaces was done with favorable results. Intermittent or continuous enrichment gave a 40-percent increase in iron production and a substantial reduction in coke consumption. Equipment for rolling parallel wide-flange beams was installed, and preliminary runs were made in November. The parallel wide-flange, flat-surfaced beam provides simpler connections with rivets, bolts, and welding than does the conventional I-Beam; thus use of the parallel wide-flange beam was increasing rapidly in building construction. Continued improvements were made in plant and equipment including equipment to produce studded and angle fence posts. The corporation was awarded a contract to produce 187 miles of high-quality 8-⅝-inch beveled seamless pipe for the Bureau of Mines 430-mile helium pipeline system in Kansas, Oklahoma, and Texas. Each length was subjected to X-ray to detect flaws; minute inside and outside inspections were made. Precise measurements of outside diameter and of the 30-degree bevel were required.

Rio Blanco.—The county continued to lead the State in petroleum production. Major producing fields were the Weber pool of the Rangely field and the Wilson Creek field, producing respectively from the Morrison and Sundance formations. Secondary-recovery operations of The California Oil Co. at the Rangely-Weber field proceeded as planned. Production from the pool represented 85 percent of the total in the county and 37 percent of the total in the State. At the end of the year a cumulative total of 95.7 million barrels of water had been injected into the pool through 71 injection wells. Water was from 12 water source wells within the field; petroleum output was from 366 wells of which 14 were flowing wells. Progress continued on construction of the White River water-treating plant which was to provide additional sources of water for the waterflood operation. Completion of the plant was scheduled for early in 1963. Eleven exploratory wells completed were failures; of 34 development wells completed 8 were oil wells and 5 were gas wells. The California Oil Co. operated its multiple-unit natural gas processing plant at Rangely. Oil well gas was treated at six absorption units within the Rangely field; the absorption oil was stripped of liquids at a single processing plant. Throughput at the plants was 43.7 billion cubic feet with the recovery of 59.1 million gallons of natural gas liquids. Some residual gas was used for plant fuel; for pressure maintenance, 87 percent was injected into the field through 18 injection wells. Coal production from the Rienau mine operated by Jenkins & Mathis

Coal Co. and the White River mine operated by Staley-Gordon Coal Co., Inc., was below that of 1961.

Uranium ore production from three mines was processed at plants at Rifle and Grand Junction. Vanadium oxide contained in the uranium ores also was recovered at the processing plants.

Building and fill sand and building gravel were produced by Albert Kirkpatrick and Bob Steele & Sons Co. The bulk of the sand and gravel production was paving gravel mined by contractors for the State highway department for use in construction work on Federal-Aid Highway No. 40 and connecting highways. Total production of sand and gravel was 237,700 tons compared with 3,300 tons in 1961. Crushed stone for highway construction was produced by contractors for the State highway department.

Routt.—Coal production from five mines (three underground, two strip) was 9 percent above that of 1961. Output by The Pittsburg & Midway Coal Mining Co. at the Edna strip mine and by Energy Coal Co. at the Energy strip mine represented the bulk of the total production in the county. The Energy mine, 20 miles southwest of Steamboat Springs, was developed by Morgan Coal Co. of Indianapolis through its subsidiary, the Energy Coal Co.; production began in November. Mining of the 30-foot seam of coal under 45 feet of overburden was completely mechanized; the crushing and loading plant was controlled through a pushbutton console. Coal was shipped to thermal powerplants in the Denver area over a 12-mile spur line built by Denver & Rio Grande Western Railroad Co. to its main line at Milner and thence to Denver. Early in 1962, PSC completed a contract with The Pittsburg & Midway Coal Mining Co. and Energy Coal Co. for delivery of 11.9 million tons of coal over a period of 15 years. The Pittsburg & Midway Coal Mining Co. was to supply 5.9 million tons, and Energy Coal Co. was to supply 6.0 million tons. The Denver & Rio Grande Western Railroad Co. was to transport the coal in 60- to 70-car trains daily when full operation schedules were reached. Other production was from the Cardinal mine operated by Dry Creek Coal Co., the Babson mine operated by Hayden Coal Co., and the Keystone mine operated by Routt Mining Corp.

Petroleum production, 9 percent below that of 1961, was from 15 wells in 5 fields; most of the petroleum was from the North Sage Creek field. One exploratory well, 9 miles north of the nearest production in the Hidden Valley field and 2 miles from the nearest drilling, was a discovery in the Mancos shale. One development well completed in the Sage Creek field was successful.

Contractors for the State highway department produced sand and gravel, more than double that of 1961, for surfacing Federal-Aid Highway No. 40, west of Rabbit Ears Pass. Crushed stone, also produced by contractors, was used on the same project. Production of volcanic cinders, more than double that of 1961, by McCoy Aggregate Co., was used as railroad ballast and for manufacturing cinder block.

Saguache.—Uranium ore production from five mines was somewhat below that of 1961. Exhaustion of minable ores at the Kathy Jo, Los Ochos, and Section 3 mines operated by Gunnison Mining Co. forced the company to close its processing plant at Gunnison early in April. Production from the Erie mine operated by Pinnacle Exploration Co. and the Mercury mine operated by Coltex Mining Co.

was processed at the Cotter Corp. plant at Canon City. Paving gravel was produced by contractors for the State highway department. Individuals and gem shops collected specimens of agate, bloodstone, minerals, opal, quartz, and turquoise near Doyleville, La Garita, and Villa Grove.

San Juan.—With the resumption of operations by Standard Metals Corp. at the Sunnyside mine and Shenandoah mill at Silverton, the value of gold, silver, copper, lead, and zinc output increased 13-fold over that of 1961. An extensive rehabilitation and development program through the American Tunnel in Cement Creek, 7 miles from Silverton, was begun to explore the area below the long-abandoned Sunnyside mine workings. Extensive development work on the Washington Vein was continued in the American Tunnel; limited work was done on the Belle Creole mine. The George Washington shaft was completed and a cage hoist was installed to serve all levels from the American Tunnel to the "F" or Terry Tunnel level. The Shenandoah mill at Silverton, owned by Standard Metals Corp., was rehabilitated and a modern flotation plant installed. Operation of the mill, with crude ore from the workings above the American Tunnel, began on August 6. Shipments of gold, copper, and lead ores, respectively, were made from the Brooklyn mine by Richardson Mines, the Copper Queen mine by Russell Blaisdell, and the Pride of the West mine by G. W. C., Inc. Reports [9] on metallurgical studies of manganese ores from the Silverton area, conducted at the Bureau of Mines Metallurgical Research Center at Salt Lake City, were published. A. A. McCluskey produced brown iron ore at the South Mineral Placer mine for manufacturing paint pigments.

Sand and gravel production, nearly 20-fold that of 1961, was by crews and contractors for the State highway department. Individuals and gem shops collected specimens of manganese, tungsten, and other minerals near Silverton.

San Miguel.—The value of gold, silver, copper, lead, and zinc output, all from that part of the Idarado mine lying in San Miguel County, was slightly above that of 1961. The county was ranked first in the State in producing gold, copper, and lead, second in silver, and seventh in zinc. The entire output of the Idarado mine lying in Ouray and San Miguel Counties was concentrated at the Idarado mill at Pandora. Uranium-ore production from 72 operations, compared with 94 operations in 1961, was 4 percent below that of 1961. The county was third in the State in the output of uranium ore. Major producers were Union Carbine Nuclear Co., Dulaney Mining Co., Climax Uranium Co., and Lowell Statts. Some adjustments in production rates were necessary after April 1 when the 1962–66 program of procurement of uranium oxide by AEC became effective. Production of brown iron ore from the Iron Lode No. 3 by Theresa B. Robinson for soil amendment and at the Iron Springs Placer by C. K. Williams & Co. for manufacturing paint pigments at plants in Illinois and Pennsylvania was triple that of 1961.

[9] Agey, W. W., C. H. Schack, and J. B. Clemmer. Metallurgical Studies of Rhodonite ores, Silverton District, Colorado (in three parts). 1. Beneficiation Tests to Produce Manganese Concentrates. BuMines Rept. of Inv. 6055, 1962, 16 pp.
Fuller, H. C., and V. E. Edlund. Metallurgical Studies of Rhodonite Ores, Silverton District, Colorado (in three parts). 2. Producing Silicomanganese by Electric Furnace Smelting. BuMines Rept. of Inv. 6062, 1962, 12 pp.

Sand and gravel production by contractors for the State highway department was used for construction work on State Highway No. 80. Output was 63 percent below that of 1961.

Summit.—Sand and gravel continued to be the most important mineral commodity produced in the county. Output in 1962 represented 96 percent of the total value of all mineral production, compared with 82 percent in 1961. Giberson Sand & Gravel and C. Ryan & Son produced building sand and gravel which reflected the substantial building boom in Breckenridge and at the relocated town of Dillon. The original town of Dillon was relocated and largely rebuilt to anticipate inundation of the original site when the Blue River Dam is completed. Breckenridge enjoyed a building boom because of the development of ski runs, making it a winter sports area, and the construction of summer homes. Extensive rebuilding of State and county highways in the Blue River Dam area and elsewhere was necessary to provide for anticipated increased traffic to the sports and recreation areas. Paving sand and gravel production by crews and contractors for the State highway department and fill sand produced by crews for the county highway department represented 65 percent of the total output during the year. Crushed stone production by contractors for the State highway department increased fourfold over that of 1961 because of the accelerated road construction program.

Output of gold, silver, lead, and zinc dropped sharply. Total value of metal output was 99 percent below that of 1961. Wellington Mines Association (Consolidated Parnett Corp.) continued developing the Wellington mine in French Creek, east of Breckenridge. A fire destroyed the surface buildings at the entrance of the mine in September. The surface plant was rebuilt, and a 150-ton-per-day flotation plant was moved from Crested Butte and installed at the mine. Underground development was continued, and operation of the mine and mill was scheduled to begin early in 1963. No shipments of ore or concentrate were made in 1962. Metal output was from the Ballard mine operated by Burton Burkholder & Tom Moran and the Glanes Placer mine operated by Marie Roberts. Specimens of silver and lead minerals were collected at the Silver Wing, Star of the West, and Grand Trunk mines.

Teller.—Gold and silver output was limited to cleanup operations at the Carlton mill near Cripple Creek by The Golden Cycle Corp. The total value of the recovered metal was 49 percent of that in 1961, when 12 mines were active. The Carlton mill was operated through January to process accumulated ores at the mill and at mines that had suspended operations on January 1. Mines in the district and the Carlton mill were placed on standby pending possible resumption of operation. However, by necessity, equipment at the major producing mines was dismantled and removed; only a few pumps required to prevent complete flooding of lower levels remained. Peat production, used for soil conditioning and as a vehicle for organic fertilizers, was slightly above that of 1961. Pikes Peak Granite Co. produced rough dimension granite for monuments. Wayne Bangert produced crushed sandstone for use as an aggregate, and contractors produced crushed stone for the State highway department. Individuals, gem shops, and gem societies collected specimens of amazonite and other minerals in the Crystal Peak and Cripple Creek areas.

Washington.—Petroleum production from 407 wells in 59 fields was 3 percent below that of 1961; sales of natural gas declined 8 percent. The county, retaining its rank as second in the State in petroleum output, was the focal point of all drilling in the Colorado portion of the Denver-Julesburg basin. There were 260 completions: 147 exploratory wells and 113 development wells. Six of the exploratory wells were successful; 49 of the infield wells were producers.

The most significant discovery was the Blade field, slightly north and 4 miles east of Bison field, a 1960 discovery. The discovery well, completed in March, pumped 275 barrels of oil per day and provided the incentive for expanded drilling during the remainder of the year. A stepout well, 34 miles to the northeast, pumped 224 barrels of oil a day; subsequent drilling joined the discovery and stepout wells into a single field. Development drilling added 12 more wells to the field by the end of the year. The other discoveries were within 22 miles of the Blade field: The Cope field, 21 miles to the east; the Harrisburg field, 5.5 miles north and east; the Oxbow field, 22 miles to the northwest; and the Trader field, 6 miles to the northeast. Additional development drilling was conducted at the Bison field—seven new wells; at the Rush-Willadel field—six new wells; at the Zenia field—six new wells; and at the Cope, Lindon, and Trader Pod fields. Continental Oil Co. operated its natural gas plant at the Little Beaver field. Intake of oil well gas at the plant was 2.5 billion cubic feet with the recovery of 22.1 million gallons of natural gas liquids.

Because completion of highway projects lowered the demand for road-building material, production of sand and gravel and crushed stone was very small compared with that of 1961. Maintenance crews produced paving gravel and contractors produced crushed stone for the State highway department.

Weld.—Coal and petroleum, principal mineral products of the county, accounted for 80 percent of the total value of mineral production. Coal output from six underground mines was 1 percent below that of 1961. Boulder Valley Coal Co. operated its Boulder Valley No. 3 mine; The Clayton Coal Co. operated the Lincoln and Washington mines; The Imperial Coal Co. operated the Eagle and Imperial mines; and McNeil Coal Corp. operated the Sterling mine. Petroleum production, from 120 wells in 33 fields, was 16 percent above that of 1961. Exploration drilling resulted in 3 discoveries from 17 wells completed. Of 32 development wells drilled, 16 were oil wells and 3 were gas wells. Two of the discoveries were significant. The Mustang field, 4 miles northwest of the one-well Vim field and less than 3 miles south of the Colorado-Nebraska State line, flowed 250 barrels of oil per day from the "D" sandstone. Two additional flowing wells were completed before the end of the year. A new producing horizon was discovered at the New Raymer field which was discovered in 1960. The discovery well flowed 231 barrels of oil per day from the "J" sandstone; previous production was from the "D" sandstone. Sales of natural gas were double those of 1961. McWood Corp. began operating a new natural gas plant at the Roggen-Southwest field in October. Gas intake at the plant for 3 months was 250 million cubic feet with the recovery of 552,636 gallons of natural gas liquids.

Sand and gravel production was 26 percent below that of 1961. Building and paving sand, fill sand, and paving gravel were produced

by Max Torrez Sand & Gravel and Moffat & Son. Paving gravel was produced by crews and contractors for the State highway department, paving sand and gravel was produced by maintenance crews for the county highway department, and paving gravel was produced by crews for the city of Greeley.

Crushed stone for riprap and road construction was produced by contractors for the State highway department. The Great Western Sugar Co. produced lime for sugar refining at its Eaton, Greeley, and Windsor plants. Gem shops and mineral societies collected specimens of agate, barite, jasper, and petrified wood near Stoneham.

The Mineral Industry of Connecticut

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Connecticut Geological and Natural History Survey for collecting information on all minerals except fuels.

By Joseph Krickich [1]

A RECORD of $19.8 million, a 19-percent increase over the previous high in 1961, was reached by the mineral industry of Connecticut in 1962. Increased building activity and accelerated highway construction were the major factors influencing the increased mineral output and establishing a record year for sand and gravel production. Output of feldspar also continued to increase. Demand for the other mineral commodities remained relatively stable. Hartford County again led in value of mineral production, followed in descending order by New Haven, Litchfield, and Fairfield Counties.

TABLE 1.—Mineral production in Connecticut [1]

Minera	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Beryllium concentrate ---- short tons	2	$1	7	$4
Clays [2] ---- do	149,101	260	178,942	287
Gem stones	(3)	9	(3)	8
Lime ---- short tons	32,987	589	35,180	635
Sand and gravel ---- thousand short tons	7,499	6,633	10,208	9,244
Stone ---- do	5,206	8,616	5,090	8,816
Value of items that cannot be disclosed: Feldspar, kaolin, mica (sheet and scrap), and peat	----	491	----	760
Total	----	[4] 16,599	----	19,754

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes kaolin; included with "Value of items that cannot be disclosed."
[3] Weight not recorded.
[4] Revised figure.

[1] Mineral specialist, Bureau of Mines, Pittsburgh, Pa.

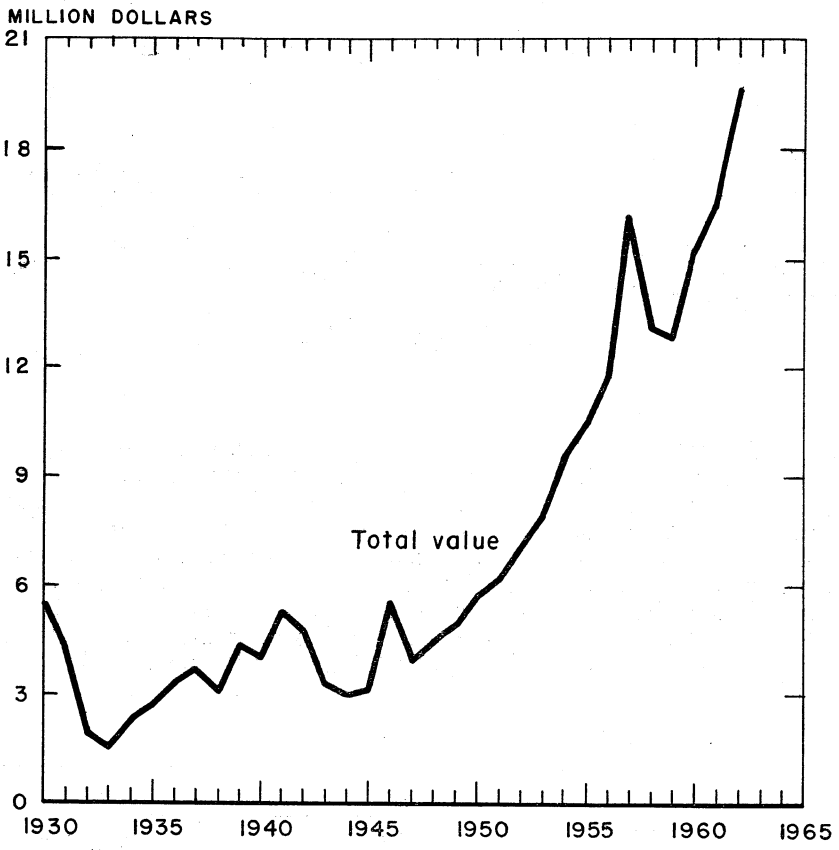

FIGURE 1.—Value of mineral production in Connecticut, 1930–62.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Plans for the construction of a $750,000 cement distribution terminal at Middletown were announced by Atlantic Cement Co., Inc. Cement produced at the company plant in Ravenna, N.Y., would be transported in specially designed ships with storage capacity of 20,000 barrels. North American Cement Corp., a subsidiary of Marquette Cement Manufacturing Co., operated a distribution plant at Bridgeport.

Clays.—Output of clay increased because of greater demand for building brick. Both kaolin and miscellaneous clay were mined. Part of the miscellaneous clay output was used in manufacturing flowerpots, but most of it was used in the manufacture of building brick. Miscellaneous clay was mined at seven pits in three counties, Hartford being the leading county. Kaolin mined in Litchfield County was transported to a company-owned brick plant in Hartford County.

Feldspar.—Production increased sharply because of expanding markets for Connecticut feldspar. The Feldspar Corp. increased production at its recently constructed flotation plant in Middlesex County. Two other grinding plants also were in operation in that county. Crude millfeed for all plants was recovered from nearby pegmatites. Ground feldspar was sold mainly for use in manufacturing glass and ceramic products and some for use in soaps and cleaning compounds.

Gem Stones.—Pegmatites in the central and western counties continued to interest mineral and gem collectors and lapidary clubs. Value of mineral specimens recovered was less than in 1961. The variety of specimens collected included agate, amblygonite, lepidolite, pollucite, quartz, rubellite, and wolframite.

Gypsum.—National Gypsum Co. calcined gypsum at New Haven from crude material shipped from outside the State for manufacturing finished building products.

Lime.—Production of lime increased 7 percent compared with that of 1961. Output was from one producer in Litchfield County. Most of the material was used to manufacture calcium and magnesium; the remainder was sold for use as mason's lime, as soil conditioner, and in insecticides. Most sales were to consumers in Connecticut and Massachusetts.

Mica.—Production of strategic-quality sheet mica dropped sharply because the Federal Government discontinued its mica purchase program for the national stockpile. The entire output of hand-cobbed and full-trim mica was sold to General Services Administration (GSA) at Franklin, N.H. No sales were made to industry. Sheet mica was recovered from three mines in Middlesex County and one mine in New Haven County. Scrap mica, recovered as a byproduct of feldspar flotation, was processed at a plant in Middlesex County for use in roofing materials.

Sand and Gravel.—Production of sand and gravel increased sharply to a record high of 10.2 million tons. The increase, which was attributed mainly to increased production by commercial producers in Hartford County, reflected greater building activity and highway construction throughout the State. Production by Government-and-contractor operations also increased. The average price of commercial sand and gravel increased from $1.01 per ton in 1961 to $1.05. Commercial operators processed 85 percent of their output compared with 80 percent in 1961. Deliveries of sand and gravel continued to be principally by truck. Fifty percent of the commercial production came from Hartford County; other leading producing areas were New Haven and Fairfield Counties.

TABLE 2.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1961		1962	
	Short tons	Value	Short tons	Value
Commercial operations:				
Sand:				
Molding	2,062	$1,138	1,625	$1,948
Structural	1,754,735	1,659,192	2,537,070	2,670,376
Paving	974,987	883,193	1,969,256	1,880,813
Fill	556,288	284,659	394,614	248,926
Other [1]	143,415	139,201	143,644	129,115
Total	3,431,487	2,967,383	5,046,209	4,931,178
Gravel:				
Structural	1,155,090	1,654,840	1,245,535	1,854,671
Paving	726,092	800,157	1,039,840	1,096,014
Fill	236,262	141,519	414,692	274,004
Miscellaneous			133,764	110,417
Other	120,326	168,340	22,363	16,688
Total	2,237,770	2,764,856	2,856,194	3,351,794
Total sand and gravel	5,669,257	5,732,239	7,902,403	8,282,972
Government-and-contractor operations:				
Sand:				
Paving	45,000	13,500	86,975	33,950
Fill			1,400	490
Other			24,534	12,952
Total	45,000	13,500	112,909	47,392
Gravel:				
Paving	1,784,550	887,475	2,189,573	912,109
Other			3,523	1,233
Total	1,784,550,	887,475	2,193,096	913,342
Total sand and gravel	1,829,550	900,975	2,306,005	960,734
All operations:				
Sand	3,476,487	2,980,883	5,159,118	4,978,570
Gravel	4,022,320	3,652,331	5,049,290	4,265,136
Total	7,498,807	6,633,214	10,208,408	9,243,706

[1] Includes filter and other sand.

Stone.—Stone production remained relatively stable. The principal stone quarried was basalt, which constituted 93 percent of the tonnage and 81 percent of the value. Other types of stone produced included granite, limestone, sandstone (quartz and quartzite), and miscellaneous stone. Basalt was produced in four counties and sold chiefly for concrete aggregate and roadstone and some for riprap and railroad ballast. Granite was quarried for dimension stone and monuments, but most of the tonnage was crushed for concrete aggregate. New London County was the leading granite-producing area. Limestone production was limited to Litchfield County, and the limestone was used chiefly for agstone (agricultural stone) and for lime manufacture. Quartzite mined in New London County was sold primarily for glass manufacture. Other uses included foundry sand, abrasives, and roofing granules. Quartz recovered as a coproduct of feldspar beneficiation in Middlesex County was marketed for glass manufacture. A limited quantity of miscellaneous stone (gneiss) was quarried in Tolland County for construction. In terms of value, New Haven County displaced Hartford County as the leading stone-producing area.

TABLE 3.—Stone sold or used by producers, by uses

Use	1961		1962	
	Short tons	Value	Short tons	Value
Dimension stone	12,068	$226,749	10,350	$217,828
Crushed and broken stone:				
Agstone	62,667	284,008	69,512	301,126
Concrete and roadstone	4,829,654	7,152,750	4,711,134	7,136,706
Railroad ballast	45,132	56,540	(1)	(1)
Riprap	98,733	153,733	74,210	114,070
Undistributed [2]	157,431	741,798	225,119	1,046,525
Total	5,205,685	8,615,578	5,090,325	8,816,255

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes flux, ground quartz, other stone, and data indicated by footnote 1.

MINERAL FUELS

Coke.—Connecticut Coke Co., a subsidiary of Eastern Gas & Fuel Associates, continued to operate its merchant coke plant at New Haven. Most of the coke and chemical products produced in the 70 slot ovens was marketed in the northeast. Coal chemical materials produced included ammonium sulfate, crude coal tar, crude light oil, and intermediate light oil.

Peat.—Output of peat decreased compared with 1961; however, an increase in the average value per ton was reported. Production was limited to Middlesex County and was sold in bulk for use as a soil conditioner.

METALS

Connecticut continued to be an important area for smelting and processing primary and secondary metals. Operations were centered in Fairfield, Hartford, and New Haven Counties. Carpenter Steel of New England, Inc., operated two electric furnaces at Bridgeport. Research was conducted on some of the rarer metals as well as on the common nonferrous metals and alloys. Work continued toward improving processes and developing new uses. Numerous foundries in the State produced castings from ferrous and nonferrous metals. Iron and steel scrap was collected, separated, and processed by many dealers for the domestic steel industry and for export.

Beryllium Concentrate.—Production of beryllium concentrate in the form of hand-cobbed beryl was higher than in 1961. Output was reported from Litchfield, Middlesex, and New Haven Counties and was sold to GSA for the national stockpile. The material had an average beryllium oxide content of 10.50 percent.

REVIEW BY COUNTIES

Sand and gravel, produced under contract for the Connecticut State Highway Department, was not attributed to specific counties. In addition, five municipalities in Hartford County, one in Litchfield County, and one in New London County reported production of sand and gravel by their own crews. Most of the Government-

and-contractor production was used for road construction, maintenance, and repairs, and some was used for sanding icy highways.

Fairfield.—Sand and gravel output totaled 982,000 tons and was virtually the same as in 1961. Twelve commercial producers were active. Material was used principally for building and highway construction, and minor quantities were used for fill and sanding roads. Most (78 percent) of the output was processed material. Principal producers were John Lomazzo & Sons Corp., Weston; D'Addario Sand & Stone Co., Newtown; Cecio Bros., Inc., Greenwich; and Grasso Construction Co., Shelton. Mineral specimens were collected in the county, primarily near Trumbull, New Hartford, and Roxbury.

TABLE 4.—Value of mineral production in Connecticut, by counties

County	1961	1962	Minerals produced in 1962 in order of value
Fairfield	$1,296,939	$1,244,391	Sand and gravel, gem stones.
Hartford	5,055,412	7,245,314	Sand and gravel, stone, clays.
Litchfield	[2] 1,898,248	2,218,713	Stone, lime, sand and gravel, clays, beryllium.
Middlesex	942,721	1,156,343	Feldspar, sand and gravel, clays, stone, peat, mica, beryllium, gem stones.
New Haven	4,367,020	5,219,840	Stone, sand and gravel, clays, beryllium, mica, gem stones.
New London	952,060	883,560	Stone, sand and gravel.
Tolland	(1)	183,990	Sand and gravel, stone.
Windham	(1)	(1)	Do.
Undistributed [3]	2,086,868	1,602,210	
Total	[2] 16,599,000	19,754,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Revised figure.
[3] Includes some sand and gravel, stone (1961), mica (1961), and gem stones (1962) that cannot be assigned to specific counties, and values indicated by footnote 1.

Hartford.—The county continued to lead in value of mineral production as output increased by more than $2 million. Commercial sand and gravel production increased from 2 to 4 million tons valued at $3.7 million. Most of it was consumed in construction of buildings and highways, but some was used for sanding roads, for filtration, and as molding sand. Eighty-six percent of the output was prepared material; all was shipped to consumers by truck. Twenty-six commercial operations were active. The larger producers included The Edward Balf Co., with plants at Burlington, Glastonbury, and Manchester; Burlington Sand & Gravel, Burlington; Connecticut Sand & Stone Corp., Avon; Costello Construction Corp., Bloomfield and Newington; Dunning Sand & Gravel Co., Inc., Farmington; Helming Brothers, Bristol; Kimball Construction Co., Newington; Materials Service, Inc., East Granby; Russak Bros., Inc., Plainville; and Angelo Tomasso, Inc., New Britain.

Basalt production totaled 2.1 million tons and was slightly above that of 1961. Most of the output was used for concrete aggregate and roadstone, but some was sold for railroad ballast and as riprap. Sherman-Tomasso Concrete, Inc., operated two quarries near Plainville. Other basalt quarries were operated by The Edward Balf Co., Newington; Arborio & Sons, Inc., Farmington; New Haven Trap Rock Co., Plainville; and Materials Service, Inc., East Granby. Di-

mension granite used in construction work was quarried near Glastonbury and East Glastonbury.

Miscellaneous clay for manufacturing building brick was mined by Kelsey Ferguson Brick Co., Suffield; Donnelly Brick Co., Kensington; Carpenter Brick & Clay Products Corp., South Windsor; and Edward W. Mack & Son, Windsor. The Keller Pottery Co. (formerly Keller-Whilldin Pottery Co.) produced common clay for manufacturing flowerpots at Kensington. Carpenter Brick & Clay Products Corp. installed a new tunnel kiln at its South Windsor plant. In addition, other facilities and automatic equipment were installed. Plasticrete Corp. began construction of a lightweight aggregate (expanded clay) plant at South Windsor. The company will use clay mined by Carpenter Brick & Clay Products Corp. The plant was scheduled for completion early in 1963 and will have a capacity of 200 tons of clay per day.

Litchfield.—New England Lime Co., division of Chas. Pfizer & Co., Inc., Canaan, quarried limestone for manufacturing lime and agstone, and for use as a filler in asphalt and rubber. Most of the lime produced was used in the manufacture of high-purity calcium and magnesium at the nearby Nelco Metals plant; the remainder was sold as agricultural lime and for use in construction. Shipments were to consumers in Connecticut, Massachusetts, New York, and Rhode Island. Conklin Limestone Co., Inc., Canaan, quarried and crushed limestone exclusively for agstone. The company improved its facilities by installing a new crusher and feeder system. Output of limestone from the Falls Village quarry of United States Gypsum Co. was used as agstone, paint filler, stucco, and metallurgical flux. Basalt was quarried at Woodbury by Building Materials, Inc., for use as concrete aggregate and riprap.

Commercial output of sand and gravel totaled 416,000 tons compared with 301,000 tons in 1961. Most of the output was used for building, paving, and highway ice control. Seven operations were active near Canaan, Lime Rock, Litchfield, New Milford, Norfolk, and Torrington. Trucks were used to deliver all the material; 79 percent was washed, screened, and otherwise prepared before shipment. Kaolin mined from a pit on Sharon Mountain by Carpenter Brick & Clay Products Corp. was shipped to the company plant in Hartford County for use in manufacturing brick. Hand-cobbed beryl produced at Parker's quarry near Woodbury was sold to the GSA purchase depot at Franklin, N.H.

Middlesex.—Feldspar production increased sharply over that of 1961. The Feldspar Corp. mined and processed crude feldspar at its recently constructed plant at Middletown. The material was beneficiated by flotation for use principally in manufacturing glass and ceramic products. The company also recovered scrap mica and quartz as coproducts in the feldspar flotation process. Deneen Mica Co. of Connecticut, also at Middletown, further processed the mica by dry grinding for use as roofing material. The coproduct, quartz, was sold for use in manufacturing glass. During the year, The Feldspar Corp. improved plant efficiency by installing a thickener and filtering system to process water used in the flotation plant. Feldspar also was mined and processed by Eureka Feldspar Mining & Mill-

ing Co., Inc., Portland, and Worth Spar Co., Inc., Cobalt. Most of the Eureka Co. output was used in ceramic applications. Worth Spar output was used as an abrasive and as a nonskid additive in cleaning compounds.

Production and value of sand and gravel decreased from that of 1961. Shore Line Washed Sand & Stone Co., Inc., Killingworth, was the principal producer. Output also was reported from pits near Moodus, East Hampton, Essex, and Middletown, and was used mainly for construction and sanding highways. Michael Kane Brick Co., Middletown, manufactured building brick from miscellaneous clay mined nearby. Reed-sedge peat was produced near Saybrook by Cedar Swamp Peat Co. Full-trim strategic-quality mica was recovered from the Tollgate mine near Middletown and from Victoria and Worth Spar mines, near East Hampton. Hand-cobbed beryl was recovered from the Andrews quarry near Portland. Both the mica and beryl were sold to GSA at its Franklin, N.H., purchase depot for the national stockpile. Mineral specimens were recovered from the pegmatites of Middlesex County.

New Haven.—Production and value of stone increased compared with that of 1961. The New Haven Trap Rock Co. quarried basalt at North Branford and Wallingford. The company added two conveyors at the Wallingford plant. Basalt also was quarried by York Hill Traprock Co., Meriden; Charles W. Blakeslee & Sons, Inc., Hamden; and A. N. Farnham, Inc., New Haven. Most of the county output was used as concrete aggregate and roadstone. Castellucia & Sons, Inc., quarried granite blocks for rough architectural stone at Stoney Creek near Branford.

Sand and gravel production totaled 1.4 million tons, 14 percent higher than that of 1961. Fourteen operations were active, producing mostly processed material for paving, construction, and fill material. Principal producers were Cinque Brothers Co. and Guilford Sand & Gravel Co., with plants at Northford and Guilford; Beard Sand & Gravel Co., Inc., Milford; Elm City Construction Co., North Haven; Meriden-Wallingford Sand & Stone Co., Inc., Wallingford; Stillman H. Rice, New Haven; and Waterbury Sand & Gravel, Inc., Waterbury. Eighty-four percent of the county output was processed material. Miscellaneous clay for manufacturing brick was produced by Stiles Brick Corp., North Haven. Strategic-quality hand-cobbed mica and beryl were recovered from pegmatites near Southbury (Benson mine) and Southford (Southford quarry), respectively. Both minerals were sold to GSA at the Franklin, N.H., purchase depot for the national stockpile. Gem and mineral collectors continued to recover material from pegmatite and other mineral localities.

New London.—Connecticut Silica Co. mined quartzite at North Stonington. Output was crushed, ground, and sized to specification for use in manufacturing glass and as foundry, abrasive, and plaster sand. Some of the output was used for roofing granules, exposed aggregate, and filler. Early in 1962, the company installed a new rod mill and screening plant. Barrett Division, Allied Chemical Corp., quarried granite at Montville for use as concrete aggregate, roadstone, and riprap. Dimension granite was quarried by Mill-

stone Granite Quarry, Inc., Waterford, and by Golden Pink Granite Quarry, East Lyme. The Golden Pink output was used for monuments; the Millstone output was used in construction and various architectural applications. Commercial sand and gravel production consisted primarily of processed material used as building, paving, and fill material. Producers were Machnik Bros., Inc., Norwich; John J. Doyle Sand & Gravel Co., Inc., Montville; Lavoie Brothers, Waterford; Westerly Ready-Mixed Concrete Co., Inc., Pawcatuck; and Locarno & Romagno, Contractors, Niantic.

Tolland.—Parker Enterprises, Inc. (formerly Earl L. Parker, Inc.), Tolland; Myron M. Lee, Bolton; and Philip Chapman produced mainly processed sand and gravel. Miscellaneous stone (gneiss) was quarried near Crystal Lake by Skyline Quarry. The gneiss was marketed as dressed building stone and rubble.

Windham.—Dunning Sand & Stone Co., Inc., produced processed building and paving sand and gravel at Plainfield. Oversize basalt boulders recovered at a pit were crushed for concrete aggregate, roadstone, and railroad ballast. Late in 1962, the company increased the primary crusher size as well as secondary crushing capacity. Sand and gravel also was produced by Ernest Joly & Sons, Danielson, and R. A. Rawson Sand & Gravel, Putnam. Most of the output was processed building and paving material. R. B. Marriott & Sons quarried granite near Oneco for use as curbing and rubble.

The Mineral Industry of Delaware

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Delaware Geological Survey for collecting information on all minerals except fuels.

By Samuel A. Gustavson [1]

VALUE of mineral production in Delaware totaled $1.5 million, an increase of 45 percent over that of 1961. The value was the second highest on record and was 8 percent below the 1955 record. The year 1962 was highlighted by increased output of sand and gravel, the principal mineral product. This resulted from an accelerated highway construction program in the State. New Castle County continued to be the leading mineral-producing area.

Employment.—Employment reported by mineral producers averaged 112 men working daily and totaled 220,000 man-hours, including about 100,000 man-hours in pits and quarries, 68,000 man-hours in processing and transporting material, and 52,000 man-hours for supervision and office work. Ten lost-time injuries, aggregating 543 days lost, were reported. This compared with 108,000 man-hours worked and 3 lost-time injuries in 1961.

TABLE 1.—Mineral production in Delaware [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Sand and gravel.....thousand short tons..	961	$970	1,755	$1,445
Value of items that cannot be disclosed: Clays, gem stones, and stone	----------	83	----------	86
Total	----------	1,053	----------	1,531

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[1] Chief, Pittsburgh Office of Mineral Resources.

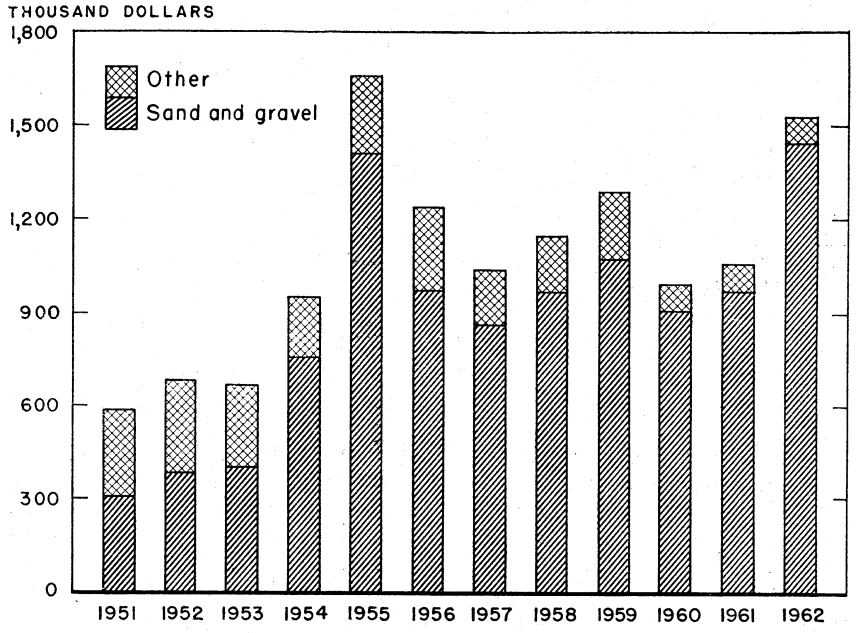

FIGURE 1.—Value of mineral production in Delaware, 1951–62.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Miscellaneous clay production increased because of increased demand for building brick. Clay produced in New Castle County was used at a nearby brick plant.

Gem Stones.—Value of mineral specimens collected by members of mineral and lapidary clubs was the same as in 1961. The seashore and rock outcrops in the State attracted collectors.

Gypsum.—Bestwall Gypsum Co. began producing calcined gypsum and finished gypsum products at its recently constructed $7.5 million plant at Wilmington. Crude gypsum was received from company mines, including mines operated in Nova Scotia and the Dominican Republic. Gypsum products included wallboard, lath, sheathing, and agricultural gypsum.

Sand and Gravel.—The production of sand and gravel continued to be the principal mineral industry in Delaware and output increased 83 percent. Production increased because of greater demand for paving material, reflecting increased highway construction activity throughout the State. The average unit value was lower because of greater demand for unprocessed material. Fourteen operations were active, compared with 12 in 1961. Gravel, constituting 75 percent of the total tonnage, was marketed for use as building, paving, and fill material. Sand was marketed as building, paving, and fill material and as engine sand. Sand and gravel for paving material repre-

sented 82 percent of the total tonnage and building material 14 percent. Ninety-eight percent of the total tonnage was shipped by truck; the remainder by rail. Approximately one-third of the total output was processed material. New Castle County continued to be the leading producing county, followed by Kent and Sussex Counties.

Stone.—Gabbro, classified as granite for statistical purposes, was the only stone produced in the State. It was crushed for concrete aggregate and roadstone and shipped to consumers by truck. The greater portion of the demand for aggregate in road building continued to be supplied from mining operations in other States.

Sulfur.—Decreased production, shipments, and value of byproduct sulfur was reported by Tidewater Oil Co. at its Delaware City refinery in New Castle County. The refinery's operating capacity continued to be 140,000 barrels of crude oil per day. The Claus process was used to recover the sulfur from crude oil received from other States and foreign countries.

METALS

Phoenix Steel Corp. operated its steel mill at Claymont. The plant had an annual ingot capacity of 506,500 short tons and consisted of seven open-hearth furnaces; two plate rolling mills of 160- and 120-inch widths, with a combined annual capacity of 300,000 tons; an electric weld mill for large-diameter pipe; a fabricating shop; and a flanging, pressing, and dished and spun head department. Pig iron for the open-hearth furnaces was supplied by the company blast furnace at Chester, Pa.

Iron and steel scrap was generated in Wilmington, Dover, and Smyra. Shipments from yards consisted primarily of Nos. 1 and 2 heavy melting steel, cast-iron scrap other than borings, stainless steel, Nos. 1 and 2 electric furnace bundles, and all other bundles, and unprepared scrap.

The American Manganese Steel Division, American Brake Shoe & Foundry Co., produced manganese steel castings and chrome molybdenum steel castings at its New Castle plant. The North American Smelting Co. produced bronze, brass, aluminum, and zinc casting alloys, solder, babbitts, and type metal at its Wilmington smelter and refinery.

Pyrites Co. at Wilmington processed a sulfate solution recovered at a Pennsylvania iron ore concentrator plant. The company produced byproduct cobalt by leaching the sulfate solution. In the past, the company recovered iron sinter and cobalt from pyrite concentrate produced by Bethlehem Cornwall Corp.

REVIEW BY COUNTIES

Kent.—The county continued to rank second as a mineral producing area, with an output of sand and gravel totaling 242,000 tons, a sharp increase over 1961. Sand and gravel was used for highway construction and maintenance, other construction, and as fill material. Processed building and paving sand and gravel was produced at Dover by St. Jones River Gravel Co. Clough & Caulk Sand & Gravel, Wyoming, produced washed and screened sand and gravel. Processed

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building material was produced by M. A. Hartnett, Inc., at Dover. Building sand and fill material were recovered by dredging operations at Harrington by Barber Sand & Gravel. Bank-run fill gravel was produced by Fisher Carpenter at Milford. Most of the county output of sand and gravel was shipped to consumers by truck and only 3 percent by rail.

New Castle.—Continuing as the leading county in mineral production, it accounted for over half of the State's total value. Output of sand and gravel nearly doubled over 1961. Most of the sand and gravel produced was used as paving material. Some building and fill material were produced. The leading producer was Parkway Gravel, Inc., which operated portable plants at Jefferson Farms and Sheldon Farms—both near New Castle. The company's entire output consisted of bank-run paving gravel. Other sand and gravel was produced by Petrillo Bros., Inc., Wilmington; Whittington's Sand & Gravel Co., Bear; Delaware Sand & Gravel Co., New Castle; and John C. Green, Jr., at Middletown. All sand and gravel produced was shipped by truck. Nearly one-fourth of the county output was processed material; the remainder was mainly bank-run paving material. Petrillo Bros., Inc., also produced granite (gabbro) from the multiple-bench, Shellpot quarry near Wilmington. The crushed rock was transported by truck from a crushing plant to nearby road-building projects. Miscellaneous clay was produced by Delaware Brick Co. from an open pit near New Castle. The clay was loaded mechanically and transported to the plant, and crushed, ground, and screened to produce building brick.

Sussex.—Sand and gravel production in the county increased over that of 1961. Forty-one percent of the county output was processed material. Approximately one-third was shipped by rail; the remainder by truck. Lewes Sand Co. produced bank-run engine sand. Construction sand and gravel was produced by Atkins Brothers, Millsboro, and Henry G. Graves & Sons, Inc., Georgetown.

The Mineral Industry of Florida

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Florida for collecting information on all minerals except fuels.

By Lawrence E. Shirley [1] and William D. Reves [2]

PRODUCTION of mineral commodities decreased for the first year since 1957; total value of mineral production was $186 million, compared with $188 million in 1961, a decrease of 1 percent. For the 69th consecutive year, Florida continued to lead the Nation in production of phosphate rock; for 23 consecutive years, zircon and for 5 consecutive years, fuller's earth. The State ranked first in staurolite, second in production of titanium concentrates, and led the southeastern States for the third year in total stone production.

TABLE 1.—Mineral production in Florida [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays—thousand short tons	513	$7,202	487	$6,741
Gem stones	(2)	(2)		
Natural gas—million cubic feet	[4] 29	5	29	6
Peat—short tons	[4] 26,67	[4] 157	21,592	138
Petroleum (crude)—thousand 42-gallon barrels	374	(3)	[4] 418	(3)
Phosphate rock—thousand long tons	13,789	95,590	13,949	94,595
Sand and gravel—thousand short tons	6,530	5,577	5,924	5,179
Stone—do	[4] 26,220	[4] 33,671	27,279	32,608
Value of items that cannot be disclosed: Cement, lime, magnesium compounds, natural gas liquids (1962), rare earth metal concentrates, staurolite, stone (dimension limestone, 1961), titanium concentrates, zirconium concentrates, and values indicated by footnote 5		45,919		46,430
Total		188,121		185,697

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $500.
[4] Revised figure.
[5] Figure withheld to avoid disclosing individual company confidential data.
[6] Preliminary figure.

[1] Mining engineer, Bureau of Mines, Knoxville, Tenn.
[2] Geologist, Florida Geological Survey, Tallahassee, Fla.

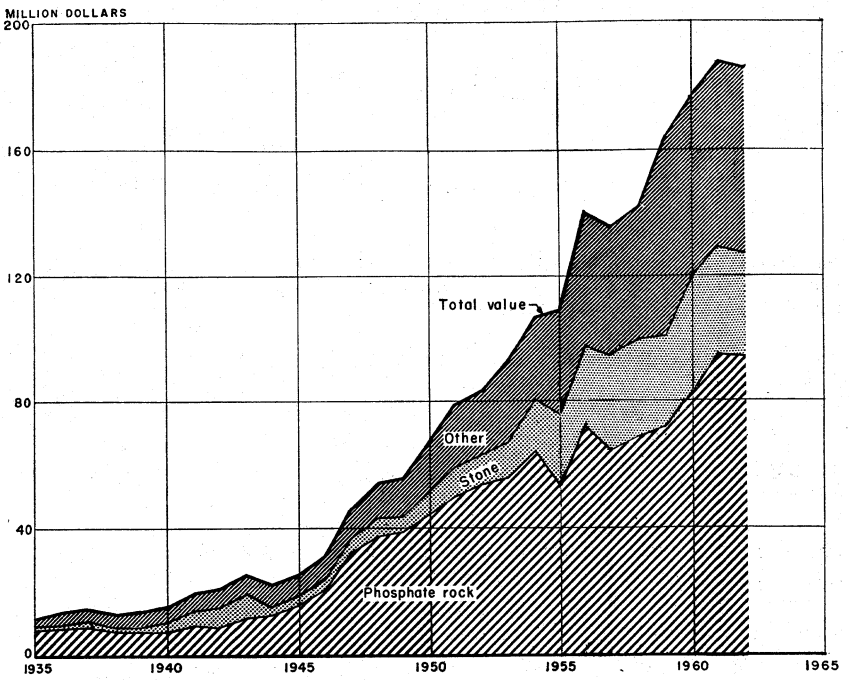

FIGURE 1.—Value of phosphate rock, stone, and total value of mineral production, 1935–62.

During the year, increases in output were recorded in land-pebble phosphate rock, crushed limestone, crushed oystershell, kaolin, lime, magnesium compounds from seawater, zircon, monazite, natural gas, and crude petroleum. Decreases were recorded in portland and masonry cement, fuller's earth, miscellaneous clay, hard and soft-rock phosphate, sand and gravel, staurolite, peat, and titanium concentrates, including both ilmenite and rutile. Fuller's earth output decreased for the first year since 1958.

The three leading companies in value of mineral production in 1962 were International Minerals & Chemical Corp., General Portland Cement Co., and Virginia-Carolina Chemical Corp.

Employment and Injuries.—Reports submitted to the Bureau of Mines by producers in the mineral industries indicated a slight decrease in activity. The number of men working daily decreased 304, or 4 percent. Total man-hours decreased 6 percent. There were 11 more injuries, and the frequency rate increased 17 percent. There were three fatal injuries, compared with none in 1961.

Consumption, Trade, and Markets.—Port activity in both imports and exports was impressive during 1962. The port of Tampa, one of the busiest Florida ports, exported large tonnages of phosphate rock and imported petroleum, cement, and sulfur. The port, estimated to be the leading port for handling sulfur in the United States, handled 13.7 million tons of total cargo for the year, including coastwise shipments.

TABLE 2.—Employment and injuries in the mineral industries

Year and industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Non-fatal injuries	Injuries per million man-hours
1961:							
Nonmetal mines	31	3,582	291	8,410,642	----------	51	6
Quarries and mills	101	2,589	278	6,105,005	----------	123	20
Metal mines and mills	5	301	350	843,734	----------	8	9
Sand and gravel mines	54	388	269	903,289	----------	20	22
Total	191	6,860	279	16,262,670	----------	202	12
1962: [1]							
Nonmetal mines	33	3,178	288	7,331,416	2	78	11
Quarries and mills	94	2,661	294	6,260,013	----------	110	18
Metal mines and mills	4	355	303	861,825	1	6	8
Sand and gravel mines	50	362	282	815,671	----------	19	23
Total	181	6,556	290	15,268,925	3	213	14

[1] Preliminary figures.

The port handled 5.6 million tons of export-import cargo, 12 percent more than in 1961; the value was in excess of $141 million, 5 percent more than in 1961. Presently in the port area are five sulfur terminals, two cement terminals, and numerous storage facilities for fertilizer materials. The port, undergoing a $15 million-improvement program, has completed one phase, which included deepening the main channel to 34 feet.

Construction continued on the new $20 million port of Miami, Dade County; it was slated for completion by 1967.

Gypsum, perlite, and vermiculite were brought in from other States and foreign countries and were processed for consumption in Florida and nearby States. National Gypsum Co. completed its new gypsum products plant at Port of Tampa, Hillsborough County, using gypsum ore from the company deposits in Nova Scotia. United States Gypsum Co., near Jacksonville, Duval County, continued operation of its plant, and calcined gypsum ore, also from Nova Scotia, for use in manufacturing building products. Vermiculite for processing by four plants was brought in from South Carolina, Montana, and South Africa. Crude perlite for processing at three plants was received from Colorado.

Phosphate rock exports, principally from the ports of Tampa and Boca Grande were slightly less than in 1961; 25 percent of the marketable product of the State was exported, 2 percent less than 1961.

Expanding markets and increased consumption were indicated for the following commodities: Lime, magnesium compounds, crushed limestone, crushed oystershell, monazite, and zircon. Cement consumption and materials used in its manufacture, such as clay and crushed stone, continued a decline begun in 1960. Fuller's earth markets declined for the first year since 1958; and there were decreases in sales of peat, hard and soft phosphate rock, sand and gravel, staurolite, ilmenite, and rutile.

Trends and Developments.—Industrial growth was characterized by 770 new plants and major expansions of existing plants in 51 of Florida's 67 counties. Dade County, continuing its rapid industrialization, led with 279 new plants, followed by Broward County with 79, and Pinellas County with 63.

Electric power requirements continued to increase. Florida Power and Light Co. announced that the company would increase its 2.4-million-kilowatt-power production 1.5 million kilowatts by 1965; three projects will add capacity to present plants, and a fourth will add a facility near Cape Canaveral. Total cost of the new facilities will be about $120 million with related projects bringing the outlay to about $300 million through 1965. Florida Power and Light Co. also announced an agreement with the Southern Co. to exchange 100,000 kilowatts of daily capacity seasonally; the Southern system would supply power to Florida from December to March, and Florida Power and Light Co. would return the same amount of electricity to the Southern Co. system from June to September. The exchange is believed to be unique. Private companies have exchanged power through linking grids in the past, but usually on a short-term basis to cover peak demands. Tampa Electric Co. at yearend had a new 200,000-kilowatt-generating facility under construction and announced that about $25 million would be spent in 1963 for a generating plant, transmission lines, and other capital facilities.

Road building continued at an accelerated pace during 1962. Projects underway at midyear totaled $217 million, and included work on 133 miles of new Interstate superhighway, 786 miles of primary highway, and 201 miles of secondary roads. Work in progress on the Interstate system consisted of four routes with a total of 1,126 miles. The most developed was Interstate 4, extending from Tampa to Daytona Beach; 35 miles of Interstate 10 was opened to traffic early in the year; Interstate 95, extending along the East Coast from the Georgia line to Miami Beach, was partially completed in the Miami area; and Interstate 75 was rapidly being completed to join the Florida State Parkway extension at Wildwood. Construction began on the Fort Pierce-Wildwood extension of the Sunshine State Parkway. Completion of major projects included opening of the $15 million airport expressway linking Miami International Airport and Miami Beach, and the opening of the $7 million Pinellas Bayway system linking offshore islands with the rapidly expanding St. Petersburg metropolitan area.

Early in the year Gulf Sulphur Co., Houston, Tex., began operating its new molten sulfur terminal in Tampa. With sulfur being transported molten instead of dry several major sulfur companies have been prompted to establish molten facilities in the Tampa area to supply the growing phosphate fertilizer complex nearby.

Legislation and Government Programs.—Under the reorganization act of 1961, the Florida State Legislature reorganized the arrangement of the Florida Board of Conservation (State Cabinet). The board, previously consisting of the Florida Geological Survey, the Department of Water Resources, and the State Department of Conservation, now is headed by a Director and comprises five divisions. The purpose of the reorganization was to strengthen the administration of State water resources. The new board consists of the (1) Division of Geology, designated as the geological and basic hydrologic data-collecting agency for the State, serves as the principal coordinator with local governments and other State and Federal agencies; (2) Division of Administration; (3) Division of Water Resources and Conservation; (4) Division of Waterways Development; and (5) Division of

Salt Water Fisheries. Each division has specific responsibilities in the field of water resources. The Division of Water Resources and Conservation published [3] a report outlining water resources data available in publications and records of the various agencies that collect such data. It was prepared as the first step in the basin-by-basin inventory of the water and related resources of the State. The Florida Geological Survey, in anticipation of action on the proposed trans-Florida barge canal revised and described [4] the mineral resources adjacent to the canal. The new inland waterway, cutting southwest across northern Florida from Jacksonville to the Tampa area will provide a link between the Atlantic and Gulf intracoastal waterways and will make possible faster barge movement of Florida phosphate and other commodities from one system to another.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Cement output, continuing a trend started in 1960, declined for the third consecutive year; portland cement decreased 7 percent in quantity and 5 percent in value, and masonry cement decreased 2 and 5 percent below 1961. Decreases over the 3-year period were attributed to radical changes in distribution, intensive competitive marketing, rising imports, and decreased activity in some phases of the construction industry in the State.

Lehigh Portland Cement Co. operated plants in Broward County, near Miami, and in Flagler County, near Bunnell; the Flagler Plant was reported closed from May through August, and upon resumption of work, to be operating at 75 percent capacity. The company acquired southeastern sites for additional cement distribution terminals in Atlanta, Ga., Durham, N.C., and Waynesboro, Va.; terminals at these locations were to be constructed during the latter part of the year and were to be in operation in the spring of 1963. The new terminals, to be supplied solely by rail, would contain 15,000 barrels of cement and provide the same facilities for rapid loading and truck delivery of cement as afforded by the larger company installations.

General Portland Cement Co. operated plants near Miami and Tampa. The company completed its major expansion project at the Tampa plant, increasing capacity to a total of 7-million barrels; major new equipment installed included a wet-process kiln, 16½ by 600-feet; four compeb mills 12 by 36 feet; and a cooler. General Portland Cement Co. displayed its new kiln, said to be the largest in operation in the United States at this time, in October at its 35th anniversary in Tampa. It was announced that General Portland Cement Co. would construct a cement distribution terminal in St. Marks, Fla.; cement produced at the Tampa plant will be transported by barge to

[3] Mohler, Frank C. Summary of Available Water Resources Data for Florida. Fla. Division of Water Resources and Conservation, March 1962, 32 pp., 8 fig.
[4] Reves, William D. Mineral Resources Adjacent to the Proposed Trans-Florida Canal. Fla. Geol. Survey, February 1962, 44 pp. (Revised.)

St. Marks for rail and truck delivery to points in northern Florida and southern Georgia.

Universal-Atlas Cement Division of United States Steel Co., which purchased cement storage and handling facilities at Port Everglades in mid-1961, announced at yearend that cement distribution facilities would be constructed at Jacksonville and Port Canaveral. The Jacksonville facility—to consist of six silos, 148 feet tall and 30 feet in diameter—is scheduled to be completed about July 1963. The Port Canaveral facility—to consist of six silos, 150 feet in height and 36 feet in diameter—will be equipped with vacuum unloading and will be supplied by boat. Rust Engineering Co., of Pittsburgh, Pa., began work on the silos in July, and expects to have them ready for use by May 1963.

The third quarter report of Penn-Dixie Cement Co., New York, announced that bulk cement transfer stations were under construction in Jacksonville, Orlando, and three other southeastern locations; purpose of the new locations was to protect and expand Penn-Dixie markets.

Atlantic Cement Co., formed in 1961 by two mining companies, Cerro Corp. and Newmont Mining Corp., is spending about $21 million on 10 new distribution stations along the East Coast. The company expects to ship 85 percent of its cement output through these terminals when its $40 million plant at Ravena, near Albany, N.Y., begins production early in 1963. Two of the distribution facilities are located at Tampa and Port Everglades; it is estimated that the Tampa storage and distribution plant having a cement capacity of 175,000 barrels, will cost $1.5 million. It is located at the head of Ybor Channel and has a deepwater dock to service ocean-going barges that will bring cement from the main plant at Ravena, N.Y. At Port Everglades, Atlantic contracted with a New York firm for the construction of a $3 million cement-distribution plant. The company expects to begin shipping cement to this plant from Ravena in early 1963.

Ideal Cement Co. completed a small cement storage plant at Tampa and made plans to make this facility a permanent terminal in the near future.

Cement imports into the Florida Customs District declined during 1961; total imports were 290,200 barrels, of which 129,500 barrels came from Colombia and 72,900 barrels from Poland. The Florida Customs District dropped from second to fifth largest importing district in 1961.

Clays.—Total clay production—including fuller's earth, kaolin, and miscellaneous clay—decreased 5 percent in quantity and 6 percent in value from that of 1961. Florida for the fifth consecutive year ranked first in production of fuller's earth; output and value were less than that of 1961, the record year.

Fuller's earth was mined in Gadsden County by Minerals & Chemicals Philipp Corp.; Floridin Co., Inc.; and Magnet Cove Barium Corp., listed in order of output. The Minerals & Chemicals Philipp Corp. plant for processing fuller's earth, mined in Florida and processed nearby in Georgia, was described.[5] A flowsheet of the milling

[5] Chopey, N. P. Attapulgite: 1 Process, 90+ Grades. Chem. Eng., Process Flowsheet, v. 68, No. 26, Dec. 25, 1961, 3 p.

process is given. Various grades of the material are used as purifying agents for refining petroleum; as carriers and diluents for insecticides, herbicides, and other agricultural chemicals; as additives for drilling muds; as floor absorbents for oils and greases; as ingredients for pharmaceuticals and cosmetics; and for other applications. Magnet Cove Barium Corp. became a wholly-owned subsidiary of Dresser Industries, Inc., Dallas, Tex. In addition to its fuller's earth activities, Magnet Cove was active in North Carolina in phosphate exploration and land acquisition in the Pamlico and Pungo River area; Magnet Cove joined with Smith-Douglass, Inc., producer of Florida land-pebble phosphate in this venture.

Kaolin output and value increased, halting a decline begun in 1960. Edgar Plastics Kaolin Co. and United Clay Mines Corp., both in Putnam County, were again the only kaolin producers. Edgar Plastic Kaolin Co. announced late in the year the formation of Edgar Minerals Corp., which will be responsible for complete sales and service functions of the parent company. Edgar Minerals has its headquarters in Gainesville.

Miscellaneous clay production and value decreased 4 percent in both from that of 1961, owing principally to lower amounts of clay used in cement. Miscellaneous clay was mined by General Portland Cement Co., Citrus County, for use in cement; Solite Corp., Clay County, for use in lightweight aggregate manufacture; and Appalachee Correctional Institute, Gadsden County, a State concern, for making brick. Late in the year Fisher Tile Co., Tampa, announced that construction had begun on a new tile plant at Deland; the plant, expected to be operational in 1963, will produce clay roofing tile, chimney tile, and some bathroom tile.

Gem Stones.—For the first time in several years, no gem stone production was reported. World Gems Corp., formerly of Atlanta, Ga.—large import-export firm of cut, rough, and specimen stones—announced that the entire operation had been moved to Miami, Dade County.

Gypsum.—No crude gypsum was produced in the State, but calcined gypsum was produced by two companies for use in manufacturing building products. United States Gypsum Co., near Jacksonville, Duval County, continued its gypsum-products plant, using crude ore from out-of-State. National Gypsum Co., which started construction of a gypsum products plant in 1960, at Port Tampa, completed the plant and began production in August. To build up a stockpile of between 70,000 and 100,000 tons of crude gypsum rock, shipments from Nova Scotia deposits were being imported. The 63d company plant throughout the Nation began operation with two crews, after six months the plant was scheduled to be operated for 24 hours with three crews. Kaiser Gypsum Co., a wholly owned subsidiary of Permanente Cement Co., made plans in 1960 for the construction of a $3-million plant near Jacksonville. It was reported that Kaiser had bought ore deposits in Nova Scotia to supply the proposed Jacksonville plant and other operations that Kaiser planned to establish in the East.

Lime.—Primary lime was produced in three counties by three companies. Lime output, based on revised figures for 1961, increased 55

percent in output and 54 percent in value. (Two companies included in 1961 totals were reclassified as regenerated lime producers.) Primary producers, listed in order of output, were Michigan Chemical Corp., Gulf County, chemical quicklime; Chemical Lime, Inc., Hernando County, chemical quicklime and hydrated lime; and Dixie Lime and Stone Co. (Ocala No. 1 limekiln), Marion County, quicklime for construction purposes and chemical hydrated lime. Chemical Lime, Inc., Brooksville, whose plant was completed in late 1961, operated for its first full year. The plant, employing a fluidized-bed 5-stage, 200-ton-per-day calciner, was described.[6] The fluidized-bed calciner was reportedly the largest of its type ever installed, and incorporated several improvements in design responsible for increased capacity, lowered fuel consumption, and reduced maintenance costs. Limestone preparation and equipment used by Camp Rock Co., supplier of raw material to the plant, was also summarized.

Regenerated lime for manufacturing pulp, paper, and other uses was produced by seven companies in seven counties. Total regenerated chemical lime used was 444,000 tons valued at $5.9 million. Leading counties were Taylor, Bay, and Gulf Counties; other counties reporting production were Dade, Duval, Nassau, and Putnam. Leading companies, in order of tonnage used, were Buckeye Cellulose Corp., Taylor County; International Paper Co., Bay County; and St. Joe Paper Co., Gulf County. All of the quicklime was used for pulp and paper except that used by the City of Miami (Hialeah Limekiln), Dade County, in its own water purification and softening plant; this plant received a Certificate of Achievement in Safety for 1961 by working 27,884 man-hours without a disabling work injury. The National Lime Association Safety Competition was sponsored by the Bureau of Mines.

Magnesia.—Florida ranked third in the Nation in magnesium compounds sold or used. Michigan Chemical Corp., Port St. Joe, Gulf County, in its fourth year of production of magnesium compounds from seawater, increased output and value considerably over 1961, establishing a record year. The company produced both caustic-calcined and refractory magnesia; uses included wallboard, cellulose, fertilizer, and rubber.

Perlite.—Expanded perlite was produced by three companies in three counties; output and value increased over that of 1961, a year of a substantial decrease. Combined output of the three processors was 7,900 tons, valued at $516,000, compared to the 1961 output of 7,000 tons, valued at $452,000. Producers, listed in order of output, were Tennessee Products and Chemical Corp. (Tennsulate plant), Duval County; Airlite Processing Corp. of Fla. (Vero Beach plant), Indian River County; and Perlite, Inc. (Hialeah plant), Dade County. The material was for building plaster, concrete aggregate, soil conditioning, filter aids, and other uses.

Phosphate Rock.—Florida led the Nation, for the 69th consecutive year, in total marketable production of phosphate rock. Total tonnage increased 1 percent for a new record, but value decreased 1 percent below that of 1961; there were increases in output of land peb-

[6] Trauffer, Walter E. Florida's New 200 TPD Lime Plant. Pit and Quarry, v. 54, No. 11, November 1962, pp. 126–140.

ble, but hard and soft rock production declined considerably. Combined marketable production totaled 13.9 million tons, valued at $94.6 million. Land pebble production comprised 99 percent of the total used or sold and was credited for the gain in tonnage. Hard-rock output decreased 29 percent in tonnage and 28 percent in value; soft rock output decreased 23 and 17 percent, continuing a decline begun in 1959.

TABLE 3.—Phosphate rock sold or used by producers, by uses

Use	1961			1962		
	Long tons	Value		Long tons	Value	
		Total	Average per ton		Total	Average per ton
Ordinary superphosphate	4,316,257	$31,359,113	$7.27	4,962,937	$34,618,450	$6.98
Triple superphosphate	2,023,112	14,677,734	7.26	2,109,851	14,726,692	6.98
Phosphoric acid (wet process)	1,900,621	12,476,084	6.56	1,979,443	13,315,432	6.73
Elemental phosphorus, ferrophosphorus, phosphoric acid	376,844	2,629,320	6.98	592,176	4,141,563	6.99
Direct application to the soil	471,206	3,426,949	7.27	437,175	3,058,217	7.00
Stock and poultry feed	260,452	1,904,636	7.31	256,824	1,818,446	7.08
Nitraphosphate	14,700	106,640	7.25			
Other fertilizers	20,000	145,600	7.28			
Exports	3,396,128	22,643,729	6.67	3,388,767	22,924,418	6.76
Total	12,779,320	89,369,805	6.99	13,727,173	94,603,218	6.89

TABLE 4.—Marketable production of phosphate rock

(Thousand long tons and thousand dollars)

Year	Hard rock		Soft rock		Land pebble		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	83	$678	70	$449	9,953	$61,622	10,106	$62,749
1958	87	737	53	414	10,711	67,800	10,851	68,951
1959	78	666	52	414	11,434	70,128	11,564	71,208
1960	77	670	47	384	12,197	81,476	12,321	82,530
1961	81	746	42	325	13,666	94,519	13,789	95,590
1962	58	538	32	270	13,859	93,787	13,949	94,595

Mine production of land-pebble crude ore, dry, was 49,336,000 long tons with a P_2O_5 content of 7,057,000 tons, a decrease of 9 percent in tonnage and an increase of 6 percent in P_2O_5 content over the 1961 figures. A total of 13,624,000 long tons of processed materials with a P_2O_5 content of 4,460,000 tons was sold or used. Land pebble for agricultural uses totaled 7,723,000 tons or 57 percent; for industrial uses, 2,512,000 tons or 18 percent; and for export, 3,389,000 tons or 25 percent. Agricultural uses were divided as follows: 64 percent in the manufacture of ordinary superphosphate, 27 percent in triple superphosphate, and the remaining 9 percent in direct application to the soil, stock and poultry feed. For industrial uses, 79 percent went into manufacture of wet-process phosphoric acid, and the remaining 21 percent was consumed in production of elemental phosphorous, ferrophosphorous, and phosphoric acid. A total of 798,000

tons of processed material with a P_2O_5 content of 255,000 tons was both purchased from and sold to mining companies, an interchange common to the industry.

Land-pebble phosphate was produced from 16 mines in Polk and Hillsborough Counties by 9 companies. Producers, listed in order of output were International Minerals & Chemical Corp. (Achan and Noralyn mines); American Agricultural Chemical Co. (Palmetto, South Pierce, and Boyette mines); Virginia-Carolina Chemical Corp. (Clear Springs and Homeland mines); American Cyanamid Co. (Orange Park and Sydney mines); W. R. Grace & Co., Davison Chemical Division, Bonny Lake mine); Swift & Co. (Varn, Watson and Silver City mines); Armour Agricultural Chemical Co. (Armour mine); Smith-Douglass Co., Inc., (Tenoroc mine); and New Concept Co. (Green Bay mine).

Hard-rock phosphate was mined by only one company, Kibler-Camp Phosphate Enterprise (section 20 and 26 mines), Citrus County. Total marketable production was 58,000 long tons valued at $538,000. Hard-rock phosphate was used for manufacturing elemental-phosphorous and ordinary superphosphate.

Soft rock phosphate was produced by five mines in three counties. Producers, listed in order of output, were Soil Builders, Inc. (Mincoll mine), Sun Phosphate Co. (Dunnellon mine), both in Citrus County; the Loncala Phosphate Co. (Mona mine), Gilchrist County, Kellogg Co. (Kellogg mine), Citrus County; and The Loncala Phosphate Co. (Minehead mine), Marion County. Total marketable production was 32,000 tons valued at $270,000, a considerable decrease below 1961. All of the material was used in stock and poultry feed and for direct application to the soil.

International Minerals & Chemical Co. continued as the leading producer of land-pebble phosphate. Erection of a new 35-cubic yard dragline named the Master Miner was completed early in the year; the relationship of the huge machine to the company operation was described.[7] The new excavator weighs 1,625 tons, has a 225-foot boom—which can move through a typical 90° cycle in about 40 seconds—and is capable of moving almost 50,000 cubic yards of material, including overburden and phosphate rock, during a three-shift day. The dragline is electrically-powered, contains 59 electric motors from ½ to 1,500 h.p., and employs a static control system using the power of magnetic fields to change the speed and direction of the drive motors. Efficient correlation of mining and plant operations between the dragline operator and the company is controlled by use of short-wave radios. The new excavator takes the place of a smaller dragline at the Achan mine and will supply phosphate ore to the newly-relocated Achan washer completed early in the year at a cost of $500,000. Late in the year the company stepped up production at its Noralyn mine, near Bartow; production was increased from 2 shifts, 5 days per week, to 3 shifts, 7 days per week. Acid, Inc., Bartow, began operation of its new 600-tons-per-day sulfuric acid plant; output will go to the International Minerals & Chemical Co. phosphate

[7] Excavating Engineer. Master Miner Gets Deepdown Paydirt. V. 56, No. 11, November 1962, pp. 5–13.

fertilizer complex at Bonnie. International Minerals & Chemical Co. presented a paper [8] on open pit mining of phosphate.

Virginia-Carolina Chemical Corp. (V–C) announced plans, about midyear, for a $40-million expansion and replacement program throughout the company to be made during the next 4 years; major outlays will boost output of phosphorous-derived organic and inorganic chemicals, phosphate mining operations in Florida and Tennessee, and fertilizer production. V–C, under terms of a lease agreement between the company and the Florida Game and Fresh Water Commission, made available an 1,100-acre tract of phosphate land near Medulla for Polk County recreational purposes. V–C recently paid $5 million for the land and is holding it in reserve for future phosphate mining. In the V–C Annual Report for the fiscal year ending June 30, 1962, the company announced that production of phosphate rock was at an alltime high and that substantial reductions in operating costs were realized; the 1962 fiscal year also marked the first full year of operation of the new flotation plant at Clear Springs mine in Polk County; the flotation operation was described.[9] Other important achievements by the company included continued reclamation of mined-over phosphate lands, major expenditures to control air pollution, and the construction of a water purification plant at its concentrated superphosphate plant to treat all effluent from company operations in the area, before it is released into nearby streams and rivers.

American Agricultural Chemical Co. (AAC), second largest producer of land pebble phosphate, for the second consecutive year, announced in its 1962 Annual Report, that Pamlico Mining and Chemical Corp., jointly owned by Kennecott Copper Corp. and AAC, had acquired phosphate rock deposits in North Carolina. Pamlico acquired more than 10,000 acres in Beaufort County, N.C., and exploration was in progress, but no determination had been made regarding initiation of commercial production. AAC personnel presented a paper [10] on mining phosphate rock in the State.

American Cyanamid Co., fourth largest producer of landpebble phosphate rock, announced in its Annual Report for the period ending December 31, 1962, improvements to its Brewster plant; included were additional facilities for grinding phosphate rock and for storage of triple superphosphate; a new granular triple superphosphate plant was completed. The land reclamation program of the company was described.[11] Cyanamid currently is reclaiming land at its two operating mines, Sydney and Orange Park. In addition, work is progressing at the old Saddle Creek mine, where production ceased in 1956; Cyanamid gave 740 acres of the Saddle Creek property to Polk County for development of a recreation area. The company continued its program, in effect for 5 years, of monitoring and controlling

[8] Smith, M. T., and Floyd Bowen. Open Pit Mining Florida Land Pebble Phosphate Deposits. Unpub. paper pres. at Fall Meeting, AIME Society of Mining Engineers, September 1962.

[9] Brooks, John A. Clear Springs Flotation Operation of Virginia-Carolina Chemical Corp. Unpub. paper pres. at Fall Meeting AIME, Society of Mining Engineers, September 1962.

[10] Quina, H. R. Mining Phosphate Rock in Florida. Unpub. paper pres. at Fall Meeting, AIME, Society of Mining Engineers, September 1962.

[11] Herrin, Harry. Phosphate Industry Reclamation in Florida. Dixie Contractor, v. 37, No. 10, April 1962, pp. 10–12.

air and water pollutants; twin electrostatic precipitators for dust collection were installed at the Brewster plant in early 1962 at a cost of $500,000; more than $2 million has been spent on the overall program.

W. R. Grace & Co., Davison Chemical Division, reported at yearend that it would build a plant in Florida to produce a new type of fertilizer from magnesium that will not burn or damage seedlings as some other types do. The company completed acquisition of Lyons Fertilizer Co., Tampa, a small mixed-fertilizer firm, and tentatively agreed to acquire Zonolite Co., producer and processer of vermiculite ore; Zonolite also produces chemicals and fertilizer products. Late in the year, Davison Chemical, began acquiring phosphate lands in Beaufort County, N.C. Research activities by the company included use of sea water in fertilizer manufacture and a study to determine the possibility of shipping large quantities of its anhydrous ammonia fertilizer, normally a gas, as liquid. As a liquid it would require much less space than it would as a gas.

A paper [12] was presented by company personnel concerning mining of phosphate in deep overburden.

Swift & Co. reported in its 1962 Annual Report that phosphate production continued at a high level, despite shutdowns due to current modernization and expansion. Construction was in progress at the new Silver City mine, which will replace the Varn mine. Expansion at the Watson mine is scheduled to begin in 1963.

Armour Agricultural Chemical Co. completed the Florida phase of its $60 million expansion program in midyear. New facilities included phosphate rock mining operations near Lake Hancock and phosphoric acid and triple superphosphate plants at Fort Meade. This expansion represented the largest single expenditure of the year for the company and resulted in considerable increase in output.

Smith-Douglass Co., Inc., continued to supply phosphate rock, nitrogen, sulfuric acid, phosphoric acid, and superphosphate for agricultural and industrial uses. Emphasis was placed on process and product research and development. The company is currently conducting laboratory and pilot plant experiments on new kinds and grades of fertilizers and on phosphates for industrial usage. Smith-Douglass Co. and Magnet Cove Barium Corp., Houston, Tex., announced a joint arrangement to determine the commercial feasibility of mining phosphate rock from deposits in Beaufort and Hyde Counties, N.C.; each company has a 50-percent interest in the venture, which will include flotation and beneficiation of phosphate ores, and marketing phosphatic products.

New Concept Co. continued to operate its Green Bay property by upgrading tailing materials using Cannon separators. This was the second year that the company reported production. Output increased considerably during the period. This continues to be only known phosphate operation of its type in Florida.

U.S. Phosphoric Products Division, Tennessee Corp., Tampa, reported to have the largest facilities in the world for production of triple superphosphate and diammonium phosphate, announced a plan late in the year under which Cities Service Co., an integrated

[12] McArthur, M. P. Open Pit Mining of Phosphate Rock in Deep Overburden. Unpub. paper pres. at Fall Meeting, AIME (Society of Mining Engineers), September 1962.

petroleum company, would acquire the assets and business of Tennessee Corp. The biggest product of the Tennessee Corp. in tonnage is sulfuric acid; total company potential is estimated at nearly 2-million tons annually, including its Tampa, Alabama, and Tennessee operations. Four sulfuric acid plants are in operation at Tampa—one contact plant, completed in 1961, is the largest in existence. Triple superphosphate capacity has been estimated at 700,000 tons of product; and diammonium phosphate capacity, at 200,000 tons annually. The company also produces sulfur dioxide, copper salts, zinc salts, and copper metal.

The Tennessee Valley Authority (TVA)[13] purchased 760 acres of hard-rock phosphate fields, bringing total reserves in the State to 4,800 acres, ending the present acquisition program in Florida. Prospecting in the hard-rock fields was concluded in 1961. TVA holdings contain more than a 21-years supply of phosphate raw materials, assuring the agency adequate raw materials in event of a national emergency. This year mining operations in Maury and Williamson Counties, Tenn., provided nearly 60 percent of the phosphate used in TVA operations and were supplemented with high-grade phosphate purchased in Florida. At Muscle Shoals, Ala., TVA continued construction on a 25,000-kilowatt rotating electric furnace, to be placed in operation in fiscal year 1964; it will be three times as large as the rotating furnace with which TVA pioneered in 1950. A new stainless steel phosphoric acid unit was completed and placed in test operation near the close of the year. Plans were well advanced for construction of a new nitric acid unit with which 65 to 70 percent of the acid will be manufactured directly without requiring a separate concentration step. Demonstration-scale plants at Muscle Shoals produced 248,000 tons of 8 different fertilizers, slightly more than in 1961; 263,000 tons of fertilizers were distributed for use in education programs in 40 States.

Dorr-Oliver, Inc., purchased the business and assets of Frank M. Murphy & Associates, Inc., engineers, fabricators, and constructors, located in Bartow. A new company, Frank M. Murphy Corp., was organized to carry on the business of the two companies in the State, which were primarily concerned with constructing phosphate-washing and chemical-fertilizer plants. Some of the work of Frank M. Murphy & Associates, Inc., was described.[14] Flowsheets of operations were given for typical practices in the Florida land-pebble field.

Sand and Gravel.—Output of sand and gravel declined for the second consecutive year. Total output was 5.9-million tons valued at $5.2 million, 9 and 7 percent below that of 1961. Ninety-three percent of the material was sand, and 7 percent was gravel; 91 percent of total sand and gravel was processed, and 9 percent was unprocessed. Sand and gravel was produced at 50 mines in 19 counties (42 of the plants were stationary and 8 were portable), compared with 45 mines in 25 counties in 1961. Total sand and gravel, including Government-and-contractor, was transported 53 percent by truck, 41 percent by railroad, and the remainder by waterway and other methods.

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[13] Tennessee Valley Authority. Annual Report of the Tennessee Valley Authority. Fiscal Year ended June 30, 1962, 76 pp.

[14] Houston, W. M., and W. A. Lavenue. Current Beneficiation Practices for Pebble Phosphate in Florida. Min. Eng., v. 14, No. 11, November 1962, pp. 44–49.

TABLE 5.—Sand and gravel sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Bay	(1)	(1)	(1)	(1)
Broward	137,849	$205,916	(1)	(1)
Clay	(1)	(1)	(1)	(1)
Dade	330,473	216,806	283,373	$196,605
Duval	38,848	28,776	36,739	27,214
Escambia	398,705	373,806	433,047	483,605
Gadsden	195,416	354,019	(1)	(1)
Glades	42,000	37,000	(1)	(1)
Hendry	17,000	13,500		
Hillsborough	15,375	31,390	(1)	(1)
Indian River	17,750	14,200	10,875	8,700
Jackson	300	219	8,775	6,000
Lafayette	38,880	21,384	12,600	18,900
Lake	1,075,477	752,837	916,554	677,948
Leon	(1)	(1)	107,300	140,561
Martin	71,800	68,900		
Orange	150,000	111,750	150,000	99,750
Palm Beach	228	214	345	304
Pinellas	10,000	8,500	5,400	6,000
Polk	2,456,988	1,984,164	2,157,765	1,691,019
Putnam	842,758	706,150	684,493	580,370
St. Lucie	(1)	(1)	(1)	(1)
Sarasota	54,360	80,550		
Volusia	(1)	(1)	(1)	(1)
Walton			28,400	21,037
Washington	33,750	25,000	(1)	(1)
Undistributed	602,511	541,765	1,088,229	1,220,574
Total	6,530,468	5,576,846	5,923,895	5,178,587

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 6.—Sand and gravel sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	4,760,311	$3,741,937	$0.79	4,604,726	$3,603,225	$0.78
Fill	540,928	266,696	.49	390,069	234,350	.60
Paving	621,684	596,292	.96	179,414	162,710	.91
Glass	90,899	178,973	1.97	(1)	(1)	(1)
Other [2]	179,452	239,564	1.33	323,373	517,555	1.60
Total	6,193,274	5,023,462	.81	5,497,582	4,517,840	.82
Gravel:						
Structural	150,482	188,800	1.25	(3)	(3)	(3)
Paving	186,712	364,584	1.95	(3)	(3)	(3)
Total	337,194	553,384	1.64	426,313	660,747	1.55
Total sand and gravel	6,530,468	5,576,846	.85	5,923,895	5,178,587	.87

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other sands."
[2] Includes railroad ballast, blast, filtration, engine, molding, other sands, and uses indicated by footnote 1.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Total gravel."

Sand output was 5.5 million tons, valued at $4.5 million. Construction sand was for building, paving, railroad ballast, fill, and other uses. Industrial sand produced was for glass, molding, blast, engine, filtration, and other uses. Leading sand-producing counties were Polk, Escambia, and Putnam, listed in order of output. Leading sand producers, in order of output, were Mammoth Sand Co. and Standard Sand and Silica Co., both of Polk County, and E. R. Jahna Industries, Inc., Lake County.

Gravel output totaled 426,000 tons, valued at $661,000. Gravel was produced at four mines in three counties and was used for building and paving. Leading gravel producers, in order of output were Campbell Sand and Gravel Co. (Century mine), Escambia County, and Florida Gravel Co. (Chattahoochee mine), Gadsden County.

Sand for Government-and-contractor was produced by Indian River, Lafayette, Palm Beach, and Pinellas Counties for use in road construction and maintenance. Total output of the 4 counties was 179,000 tons, valued at $134,000; 84 percent of the sand was processed, and all was transported by truck.

Staurolite.—For the second consecutive year output and value decreased 20 percent below 1961. E. I. du Pont de Nemours & Co., Inc., Clay County, the only producer in the United States for the past 5 years, recovered staurolite as one of the byproducts in concentrating titanium minerals at its Highland and Trail Ridge plants. Staurolite is used as an alumina and iron hydroxide additive in cement manufacturing.

Stone.—Florida, for the third consecutive year, led the southeastern States in total stone production and was eighth-leading State in the Nation. Total output was 27.3-million tons valued at $32.6 million, an increase of 4 percent in tonnage, but a decrease of 3 percent in value below 1961. Crushed limestone output increased 1 percent in tonnage, but it decreased 6 percent in value. Crushed oystershell, based on revised 1961 figures, more than doubled in tonnage; value was 87 percent more than in 1961. No production of dimension limestone was reported for the year. Key Marble, Inc., Monroe County, the only producer reporting in 1961, advised that it was out of business.

TABLE 7.—Crushed limestone and oystershell sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roads	[1] 22,278,900	[1] $28,171,100	[1] $1.26	23,392,816	$26,704,036	$1.14
Agstone	[1] 466,979	[1] 1,750,071	3.75	479,405	1,446,694	3.02
Poultry grit	30,988	457,338	14.76	30,769	461,535	15.00
Other uses [2]	3,444,395	3,292,883	.96	3,375,680	3,995,334	1.18
Total	[1] 26,221,262	[1] 33,671,392	1.28	27,278,670	32,607,599	1.20

[1] Revised figure.
[2] Includes cement, lime, railroad ballast, mortar (1961), asphalt filler, fill (1961), and other uses.

TABLE 8.—Crushed limestone sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Alachua	1,254,580	$1,085,110	1,261,473	$1,083,243
Broward	4,057,418	5,198,166	3,968,939	4,458,648
Collier	592,970	823,203	543,197	610,450
Dade	7,366,905	8,302 383	6,727,138	6,872,569
Hernando	4,841,868	7,501,328	4,770,171	6,546 744
Indian River	16,500	13,200	1,300	1,560
Lafayette	161,000	141,680	386,407	350,315
Levy	531,354	866,309	526,224	668,289
Marion	1,282,318	1,206,943	1,064,648	1,158,583
Monroe	281,250	354,375	275,000	275,500
Undistributed [1]	5,289,804	7,096,387	6,403 010	8,556,252
Total	25,675,967	32,589,084	25,927,507	30,582,153

[1] Includes the following counties for which figures are withheld to avoid disclosing individual company confidential data: Citrus, Columbia, Duval, Flagler, Hendry, Lee, Manatee, Palm Beach, Pasco, Sarasota, Sumter, Suwannee, and Wakulla (1961).

Crushed limestone was produced at 77 quarries in 22 counties, 6 quarries less than those producing in 1961. Total output was 25.9-million tons, valued at $30.6 million; 85 percent was for roadstone, concrete and screenings; 13 percent was for other uses and railroad ballast; and 2 percent was for agstone. Three counties, Dade, Hernando, and Broward, led in producing 15.5 million tons, valued at $17.9 million—more than 50 percent of the total tonnage and value of crushed limestone for the State. Leading individual quarries, in order of tonnage produced, were Florida Rock Products Co., Hernando County; Florida Rock Products Co., Suwannee County, and Dixie Lime and Stone Co., Sumter County. Crushed limestone was transported as follows: 60 percent by truck, 38 percent by railroad, and 2 percent by waterway. Crushed limestone for noncommercial or Government-and-contractor use was produced by five county highway departments, the same as in 1961; 288,000 tons of limestone, valued at $223,000 was produced—representing increases of 35 and 19 percent, respectively, over 1961. The material was used primarily for road construction and maintenance, and was all transported by truck. Producing counties, in order of output, were Broward, Palm Beach, Marion, Hendry, and Indian River.

Crushed oystershell was produced by six companies and six counties on 11 leases; four companies dredged oystershell on two leases, each, obtained from the State. Based on revised 1961 data, oystershell output nearly doubled over 1961. Leading producers, in order of output, were Radcliff Materials, Inc., Walton County; Benton and Co., Pinellas County; and Bay Dredging and Construction Co., Hillsborough County. Most of the oystershell was transported by waterway, but small tonnages were hauled by railroad and truck. Five companies used the oystershell for concrete, roadstone, and screenings; and one company produced it for use as poultry grit.

One of the largest crushed limestone quarries of its kind in the southeastern States was completed and placed in operation near Miami, Dade County. The new Pennsuco quarry and plant of Maule Indus-

tries, Inc. with a design capacity of 800 tons per hour, was described[15] in at least three articles during the year. Complete processing, stockpiling, blending and loading control requires only four men. The quarry, estimated to contain 1,000 acres, employs the latest drilling, blasting, and excavation techniques for underwater operation. After blasting, the material is dug with a 9½-cubic yard dragline and placed in windrows for later loading and hauling to the primary crusher. Other developments by Maule Industries, Inc., included the formation of a new Aggregates Division and jointly with Debardeleben Marine Corp., construction of a new concrete-aggregates terminal on the Port Canaveral Barging canal. It was to supply Cape Canaveral and the surrounding area by barge. The cost was $200,000.

The new crushed limestone operation of Coral Aggregates Corp., completed in 1961, was described.[16] Coral Aggregates Corp., an affiliate of Samson Concrete and Block Co., ready-mixed, concrete block, and precast concrete supplier, furnishes crushed limestone for Samson plants in Miami and Homestead.

Dixie Lime and Stone Co., Ocala, was formed through the merger of five limestone companies, formerly serving Florida and Georgia. These companies were Dixie Lime Products Co.; Dolomite Products, Inc.; and Quality Lime Products Co., all of Florida, and Georgia Lime Rock Co. and Tyrone Rock Products Company of Georgia. The new firm will produce and sell dolomite and high-grade calcium limestone for agricultural and industrial uses, crushed limestone for roads and other purposes, crushed granite for road construction, concrete aggregate and railroad ballast, and lime for chemical and construction purposes.

The new Lowell quarry and plant of Southern Materials Co. of Florida was described.[17] Construction of the new 750-tons-per-hour plant was completed around the first of the year. Lone Star Cement Corp. announced a proposed acquisition of the parent company, Southern Materials Co., Norfolk, Va. The acquisition was approved by Southern stockholders and scheduled to take effect in August.

Florida-Southern Dolomite Corp., Palmetto, completed and placed into operation a new $500,000 quarry and plant to supply agricultural limestone. West Coast Dolomite Corp., formerly West Coast Rock Co. (Venice quarry), completed modification of its quarry, and constructed facilities for an agricultural limestone operation near Venice.

Naranja Rock Co., Naranja, was sold to Consolidated Empire Co., Inc., Miami; properties included the aggregate company of Naranja, a block plant at Florida City, and a construction firm at Tavenier.

Vermiculite.—Zonolite Co. exfoliated crude vermiculite from South Carolina and Montana at three plants near Jacksonville, Duval County; Tampa, Hillsborough County; and Boca Raton, Palm Beach County. Verlite Co., a new company reporting for the first year, near

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[15] The Dixie Contractor. New Maule Quarry in Operation. V. 36, No. 45, Apr. 27, 1963, 2 pp.
Bergstrom, John H. Aggregate Plant is Electronic Marvel. Rock Products, v. 65, No. 6, June 1962, pp. 93–98.
Excavating Engineer. Quarry of Tomorrow Beats Todays Specs. V. 56, No. 9, September 1962, pp. 20–33.

[16] Trauffer, Walter E. New 300-TPH Rock Plant Supplies Miami Area. Pit and Quarry, v. 55, No. 4, October 1962, 5 pp.

[17] Herrin, Harry. Southern Materials Opens Quarry in Florida. Dixie Contractor, v. 36, No. 43, Apr. 13, 1962, 2 pp.

Tampa, Hillsborough County, produced exfoliated vermiculte from crude ore mined in South Africa. Total output and value, including both companies, was considerably more than in 1961. Zonolite, at yearend, had tentatively agreed to a merger with Davidson Chemical Division, W. R. Grace & Co., phosphate rock and fertilizer producer with operations near Bartow, Polk County.

METALS

Ferroalloys.—Virginia-Carolina Chemical Corp., Nichols, and American Agricultural Chemical Co., Pierce, produced ferrophosphorous as a byproduct of the electric-furnace process for making elemental phosphorous. Production increased 35 percent, and shipments and value were 57 and 10 percent, respectively, greater than in 1961; shipments exceeded production by 8 percent.

Rare-Earth Minerals.—Florida ranked second in the Nation in production of rare-earth minerals, exceeded only by California. Titanium Alloy Manufacturing Division of National Lead Co., near Jacksonville, Duval County, recovered monazite as a byproduct of concentrating heavy minerals from sand deposits. Production nearly doubled, and shipments and value rose slightly above those of 1961. This was the only reported production of rare-earth minerals in the State.

Titanium Concentrates.—Florida, for the seventh consecutive year, ranked second in the Nation in production of titanium concentrates, exceeded only by New York. Ilmenite and rutile concentrates production continued to decline; ilmenite was 5 percent in tonnage and 1 percent in value lower than in 1961; rutile decreased 9 percent in output and value. Florida led the Nation in rutile production.

E. I. du Pont de Nemours & Co., Inc. (Highland and Trail Ridge mines), Clay County, continued leading the State in production of ilmenite. Other producers, in order of output, were Titanium Alloy Manufacturing Division of National Lead Co. (Skinner mine), Duval County, and Florida Minerals Co. (Vero mine), Indian River County, both of whom produce ilmenite and rutile.

Zircon.—For the 23d consecutive year, Florida ranked first in zircon production. Total output of three producing companies increased 14 percent in tonnage and value. E. I. du Pont de Nemours & Co., Inc. (Trail Ridge mine) continued to be the largest producer. Other producers, in order of rank, were Titanium Alloy Manufacturing Division of National Lead Co. (Skinner mine) and Florida Minerals Co. (Vero mine). Most of the material was shipped out-of-State for use in refractories and foundries and as welding flux, but some of the material was used by Columbia-National Corp., Pensacola, in producing sponge.

MINERAL FUELS

Natural Gas.—Production of natural gas, all from the Humble Oil Company Sunniland field, Collier County, was the same as in 1961.

The new liquid-hydrocarbon plant of the Florida Hydrocarbons Co. at Brooker, Bradford County, was completed and placed into operation. The refrigerated-absorption unit is capable of processing transmission-line gas at a rate of 375 million cubic feet per day, from

which it can recover 105,000 gallons of propane, 64,000 of butanes, and 47,000 gallons per day of natural gasoline.

Peat.—Florida ranks third in the Nation in peat reserves with total known reserves of 2 billion short tons.[18] During 1962, six companies in four counties produced peat; total output was 22,000 tons, valued at $138,000, a decrease of 19 percent in tonnage and 12 percent in value. Counties listed in order of output were Orange, Hillsborough, Putnam, and Clay. Two types of peat were produced; five companies sold humus peat, and one producer in Orange County sold reed-sedge peat. The material was sold in bulk, chiefly for soil improvement purposes. Although classified as a mineral fuel, none of the peat was used for this purpose.

Petroleum.—Crude petroleum production, all from wells in the Humble Oil Co. Sunniland field, Collier County, increased 12 percent in output, but continued a slight decrease in value, as in 1961—based on preliminary data. Cumulative production to January 1, 1963 totaled 7,270,000-barrels of oil.

The Florida Geological Survey made an important contribution to the knowledge of the petroleum industry in the State. Petroleum exploration, land information, rules and regulations, production and prospects were described;[19] exploratory well information for 1961, a summary of reservoir data for the Sunniland field, and offshore drilling data were also included in appendixes.

REVIEW BY COUNTIES

Mineral production was recorded in 42 of the 67 counties, 2 less than in 1961. Polk, Hillsborough, and Dade, in order of value, were the three leading mineral-producing counties, furnishing 69 percent of the total mineral production value. The next most important mineral producing counties, in order of value, were Clay, Hernando, Flagler, Gadsden, Gulf, Broward, Citrus, Suwannee, and Duval—each having values of more than $2 million. The 10 leading counties accounted for 90 percent of the mineral production value. Twenty-five counties reported no mineral production. Crushed limestone was produced in 22 counties; sand and gravel, in 23; secondary lime was recovered in 7; primary lime, in 3; crushed oystershell, in 6; cement, soft-rock phosphate, miscellaneous clay, zircon, and ilmenite, in 3; land-pebble and hard rock phosphate, ferroalloys, and rutile, in 2; kaolin, fuller's earth, magnesium compounds, monazite and staurolite, in 1 each. Perlite and vermiculite was processed in 3 counties each; and gypsum, in 2.

Alachua.—Total value of mineral production was slightly below that of 1961; five companies produced 1.3-million tons of crushed limestone, valued at more than $1 million. The following companies, listed in order of output, crushed limestone: Houdaille-Duval Co., formerly Duval-Wright Engineering Co. (Haile quarry); Limestone

[18] Averitt, Paul, L. R. Berryhill, and D. A. Taylor. Coal Resources of the United States (a Progress Report, October 1, 1953): Geol. Survey Circ. 293, 1954, p. 38.
[19] Babcock, Clarence. Florida Petroleum Exploration, Production and Prospects. Fla. Geol. Survey, Spec. Pub. No. 9, 1962, 79 pp.

Products Co. (Haile quarry); Williston Shell Rock Co. (Buda quarry); and Peacock Lime Rock Corp. (Peacock quarry). The crushed stone was transported as follows: 79 percent by railroad, 14 percent by truck, and 7 percent by waterway; all of the stone was used for concrete, roadstone, and screenings.

Bay.—Cato Sand Co. (Mill Bayou Mine) and Calloway Sand Co., formerly Taylor Sand Co. (Silver Creek mine), both of Panama City, mined building and paving sand, all of which was transported by truck. International Paper Co. (Panama City limekiln) produced recirculated lime for use in its paper and pulp plant; this was the first year that secondary lime has been recorded for this operation.

TABLE 9.—Value of mineral production in Florida, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value
Alachua	$1,085,110	$1,083,243	Limestone.
Bay	(2)	(2)	Sand and gravel.
Broward	5,404,115	(2)	Limestone, sand and gravel.
Citrus	2,098,109	(2)	Limestone, phosphate rock, miscellaneous clay.
Clay	(2)	(2)	Ilmenite, zircon, staurolite, sand and gravel, miscellaneous clay, peat.
Collier	(2)	(2)	Petroleum, limestone, natural gas.
Columbia	(2)	(2)	Limestone.
Dade	(2)	(2)	Cement, limestone, sand and gravel.
Duval	(2)	(2)	Ilmenite, zircon, rutile, oystershell, limestone, monazite, sand and gravel.
Escambia	373,806	483,605	Sand and gravel.
Flagler	(2)	(2)	Cement, limestone.
Gadsden	(2)	(2)	Fuller's earth, sand and gravel, miscellaneous clay.
Gilchrist	(2)	(2)	Phosphate rock.
Glades	37,000	(2)	Sand and gravel.
Gulf	(2)	(2)	Magnesium compounds, lime.
Hendry	(2)	(2)	Limestone.
Hernando	(2)	(2)	Limestone, lime.
Hillsborough	19,925,715	19,885,804	Cement, phosphate rock, oystershell, sand and gravel, peat.
Indian River	(2)	(2)	Rutile, zircon, ilmenite, sand and gravel, limestone.
Jackson	219	(2)	Limestone, sand and gravel.
Lafayette	163,064	369,215	Do.
Lake	752,837	677,948	Sand and gravel.
Lee	(2)	(2)	Limestone, oystershell
Leon	(2)	140,561	Sand and gravel.
Levy	866,309	668,289	Limestone.
Manatee	(2)	(2)	Limestone, oystershell.
Marion	(2)	(2)	Limestone, lime, phosphate rock.
Martin	68,900	----	
Monroe	(2)	275,500	Limestone.
Orange	(2)	(2)	Sand and gravel, peat.
Palm Beach	(2)	(2)	Limestone, sand and gravel.
Pasco	(2)	(2)	Limestone.
Pinellas	(2)	(2)	Oystershell, sand and gravel.
Polk	88,933,410	87,952,616	Phosphate rock, sand and gravel.
Putnam	(2)	(2)	Sand and gravel, kaolin, peat.
St. Lucie	(2)	(2)	Sand and gravel.
Sarasota	(2)	(2)	Limestone.
Sumter	(2)	(2)	Do.
Suwannee	(2)	(2)	Do.
Volusia	(2)	(2)	Sand and gravel.
Wakulla	(2)	----	
Walton	(2)	453,681	Oystershell, sand and gravel.
Washington	25,000	(2)	Sand and gravel.
Undistributed	[3] 68,387,406	73,706,538	
Total	[3] 188,121,000	185,697,000	

[1] The following counties are not listed because no production was reported: Baker, Bradford, Brevard, Calhoun, Charlotte, De Soto, Dixie, Franklin, Hamilton, Hardee, Highlands, Holmes, Jefferson, Liberty, Madison, Nassau, Okaloosa, Okeechobee, Osceola, St. Johns, Santa Rosa, Seminole, Taylor, and Union.
[2] Figure witheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.

Broward.—The county again ranked ninth in value and third in output of crushed stone. Twelve crushed stone quarries were active, compared to 14 in 1961, producing 4-million tons valued at $4.5 million, a decrease of 2 percent in tonnage and 14 percent in value from 1961. Most of the stone was transported by truck and a small percentage by railroad. Ninety-six percent of the stone was for concrete, road-stone, and screenings, and the remainder was for other uses. Crushed stone producers, in order of output, were Maule Industries, Inc., (Prospect quarry); Hollywood Quarries, Inc., (Broward County quarry); R. H. Wright, Inc., (Green Quarry); Sample Rock Co., Inc., (Pompano Beach Quarry); Meekins, Inc., (Hollywood and Oakland Park No. 5 quarries); Deerfield Rock Co. (Deerfield quarry); Hallandale Rock & Sand Co. (Hallandale quarry); Ferncrest Quarries Corp. (Ferncrest quarry); Rozzo Mining, Inc., (No. 2 quarry); and R. H. Wright, Inc., (Wright quarry). The Broward County Highway Department crushed 115,000 tons of stone valued at $92,000, for use in its road maintenance program; the department was the only productive Government-and-contractor operator reporting. Florida Silica Sand Co., Inc., (Pegram mine) produced building sand; and Davie-Des Rocher Sand Corp. (Fort Lauderdale mine), formerly Davie Sand Corp., produced building and fill sand. All of the sand was transported by truck.

Citrus.—The county moved from 12th to 10th place in value of mineral production. Commodities produced consisted of hard and soft-rock phosphate, crushed limestone and miscellaneous clay. Kibler-Camp Phosphate Enterprise (section 20 and 26 mines), the only hard-rock phosphate producer in the State, mined 58,000 long tons of phosphate valued at $538,000, considerably below output and value of 1961. Eighty-four percent of the phosphate was for industrial purposes; the remaining 16 percent, for agricultural uses. Soft-rock phosphate decreased slightly in output and value below 1961; producers listed in order of output were Sun Phosphate Co. (Dunnellon mine); Soil Builders, Inc., (Mincoll mine); and Kellogg Co. (Kellogg mine). Most of the soft-rock phosphate was used for agriculture. Crushed limestone output increased 11 percent, and value nearly doubled that of the previous year. Producers of crushed limestone, in order of output, were General Portland Cement Co. (Citrus County quarry); Crystal River Quarries, Inc., (Crystal River Quarry); and Middleton Mining Co. (Dunnellon mine). The stone was for manufacturing cement, concrete, road-stone and screenings, agricultural purposes, and other uses. General Portland Cement Co. (Citrus County mine) also produced miscellaneous clay for use in manufacturing cement; output and value decreased from 1961.

Clay.—For the second consecutive year the county ranked fourth in value of mineral production, and second in peat production. In addition to peat, titanium ores, zircon, staurolite, sand and gravel and miscellaneous clay were produced in the county. E. I. du Pont de Nemours & Co., Inc. (Trail Ridge and Highland mines), produced ilmenite, zircon and staurolite. Zircon output increased; but ilmenite and staurolite output decreased. All-Florida Sand Co. (Keystone Heights mine) and King Concrete Sand Co. (Keystone Heights mine) produced building sand; combined output of the two operations was

more in both tonnage and value than in 1961. Southern Lightweight Aggregates Corp. mined miscellaneous clay at Russell for use in lightweight aggregate. Humus peat for use as a soil conditioner was produced by Tomes Peat Humus, Keystone Heights, the only producer in the county.

Collier.—Collier County was the only petroleum and natural gas producing county in the State. Crude petroleum output increased 12 percent but value decreased slightly; natural gas showed a slight increase in output and value from 1961. Crushed limestone was produced by Industrial Limerock, Inc. (Sunniland quarry); Naples Limerock Co. (Belle Meade quarry); and Sunniland Limerock Co. (Sunniland quarry), listed in order of output; combined output and value was less than in 1961. Sixty-seven percent of the stone was transported by truck; the remainder, by railroad.

Columbia.—Limerock Industries, Inc. (Columbia City quarry), formerly Limestone Products, Inc., was the only mineral producer in the county reporting production; crushed limestone output and value was considerably more than in 1961. The Loncala Phosphate Co. closed its Fort White soft-rock phosphate mine.

Dade.—The county, ranking first in crushed stone output for the fifth consecutive year, dropped from second to third ranking county in value of mineral production, a position held for the three previous years. Total output of 18 active quarries was 6.7 million tons, valued at $6.9 million—a decrease of 9 percent in output and 17 percent in value compared with 1961. Seventy-two percent of the stone was transported by truck; the remainder, by railroad and waterway. Crushed limestone producers, in order of output, were Seminole Rock Products, Inc. (Medley quarry); Ideal Crushed Stone Co. (Dade County quarry); Maule Industries, Inc. (Pennsuco quarry); Oolite Crushed Stone Co. (Richmond quarry); Three Bays Improvement Co. (Rockdale quarry); Lehigh Portland Cement Co. (Miami Limestone quarry); General Portland Cement Co. (Hialeah Gardens quarry); Coral Aggregates Corp. (Miami quarry); Joe Daniel, Inc. (Joey quarry); R. H. Wright, Inc. (Meekins quarry); Naranja Rock Co. (Naranja quarry); Sample Rock Co., Inc. (Opa Locka quarry); Seminole Quarries, Inc. (Pennsuco quarry); Miami Crushed Rock, Inc. (Coral Gables quarry); Oolite Rock Co. (Oolite Rock quarry); and Brooks Paving Co. (No. 6 and No. 8 quarries). Most of the stone was used for concrete, roadstone and screenings, and railroad ballast; Lehigh Portland Cement Co. (Miami mill) and General Portland Cement Co. (Everglades mill) crushed limestone and produced portland and masonry cement; output and value of both commodities decreased, compared with 1961. T. J. James Construction Co. (Miami mine), formerly Golden Brown Soil Co.; Des Rochers Sand Co., Inc. (Cape Florida mine); and Sample Rock Co. (Opa Locka mine) produced sand for building, paving, lawn dressing, and fill purposes; combined output and value decreased, compared with 1961. Seventy-five percent of the sand was transported by truck; the remainder, by waterway. The City of Miami (Hialeah limekiln) produced regenerated lime for water softening and as a purification agent in its municipal waterplant. Perlite, Inc. (Hialeah plant) processed perlite from Western States for use in concrete, building plaster, and soil conditioning.

Duval.—Commodities produced were ilmenite, rutile, monazite, zircon, sand and gravel, crushed limestone, and crushed oystershell; vermiculite and perlite were processed, and regenerated lime was produced at one plant, each. Titanium Alloy Manufacturing Division of National Lead Co. (Skinner mine) produced ilmenite, rutile, zircon, and monazite; output and value increased slightly, compared with 1961. Southside Sand Co. (Jacksonville mine) produced fill sand. High Springs Limerock Corp. (High Springs quarry), near Grand Crossing, crushed limestone for the second year; output and value increased considerably, compared with 1961. The stone was used for concrete, roadstone and screenings and fill. White Shell Corp. (White Shell plant), near Jacksonville, produced crushed oystershell; output and value remained about the same as in 1961. Zonolite Co. (Jacksonville plant) exfoliated crude vermiculite for various uses; the crude ore was brought in from South Carolina, Montana, and South Africa. Tennessee Products and Chemical Corp. (Jacksonville plant) processed perlite from Western States for building plaster, concrete aggregate, soil conditioning, and other uses. Owens-Illinois Glass Co. (Jacksonville limekiln) produced regenerated lime for use in paper and pulp; this was the first year that the company has reported lime output.

Escambia.—The county was second in sand and gravel output; 433,000 tons, valued at $484,000, was produced—an increase of 9 percent in tonnage and 29 percent in value, compared with 1961. Fifty-nine percent of the material was gravel, and the remainder was sand. Most of the material was used for building purposes. Forty-one percent of the sand and gravel was transported by railroad; 59 percent, by truck. Sand and gravel producers, in order of output, were Campbell Sand and Gravel Co. (Flomaton mine); Ward Gravel Co. (Century mine); Clark Sand Co. (Pensacola mine); J. W. McKay (Pensacola mine), a new producer reporting for the first year; and E. E. Boone Construction Co. (Escambia mine).

Flagler.—The county ranked sixth in value of mineral production, moving up from seventh rank in 1961. Lehigh Portland Cement Co., the only mineral producer in the county, crushed limestone from its Coquina quarry for use in manufacturing portland and masonry cement at its Bunnell mill, also located in the county. Cement output and value increased slightly, compared with 1961.

Gadsden.—The State and county, for the fifth consecutive year, ranked first in the Nation in production of fuller's earth. The county ranked seventh in value of mineral production, compared with sixth in 1961. In addition to fuller's earth, sand and gravel, and miscellaneous clay was produced. Fuller's earth output and value decreased for the first year since 1958; producers were Minerals & Chemicals Phillip Corp. (La Camelia mine); Floridin Co., Inc. (Quincy mine); and Magnet Cove Barium Corp. (Havana mine). Florida Gravel Co. (Chattahoochee mine) produced sand and gravel, and William H. Brundydge (Havana mine) produced sand. Appalachee Correctional Institute (Chattahoochee mine) produced a small tonnage of miscellaneous clay for manufacturing building brick.

Gilchrist.—The Loncala Phosphate Co. (Mona mine), the only mineral producer reporting production, mined and processed soft-

rock phosphate for use in stock and poultry feed and for direct application to the soil.

Glades.—West Coast Rock Co. (Ortona mine), formerly Caloosa Industries, Inc., produced building sand; output and value increased considerably, compared with 1961.

Gulf.—The county ranked eighth in total mineral production value, moving from ninth in 1961; the county also led the State in primary lime production. Michigan Chemical Corp. (Port Saint Joe plant) produced lime from oystershell for use in its magnesium compounds plant. The company recovered magnesium compounds from seawater and produced caustic calcined and refractory magnesia for making refractories, insulating board, rubber, fertilizer, and other uses. Consumption of magnesium compounds, sold or used, was appreciably more than in 1961, a banner year. Saint Joe Paper Co. (Port Saint Joe limekiln) produced regenerated lime for use in paper and pulp. This was the first year that this production has been reported.

Hendry.—Caloosa Rock Corp. (LaBelle quarry), and Hendry County Highway Department crushed limestone for use in concrete and roadstone and screenings; output and value remained about the same as in 1961. All of the stone was transported by truck.

Hernando.—For the second consecutive year the county ranked fifth in value of mineral production; for the third consecutive year it ranked second in crushed limestone output, exceeded only by Dade County. Total crushed limestone output was 4.8 million tons valued at $6.6 million—a decrease of 1 percent in tonnage and 12 percent in value, compared with 1961. The stone was principally for concrete, roadstone and screenings, railroad ballast, and other uses; sixty-three percent of the stone was transported by truck; the remainder, by rail. Seven quarries were active, as in 1961; producers, listed in order of output, were Florida Rock Products Corp. (Diamond Hill quarry), leading crushed stone producer in the State; Camp Concrete Rock Co. (Gay quarry); William P. McDonald Corp. of Florida (Conrock quarry); Lansing Rock Co. (Brooksville quarry); Hernando Limerock Co. (Brooksville quarry); Brooksville Rock Co. (Broco quarry); and Aripeka Limerock Co., Inc., (Aripeka quarry). Chemical Lime, Inc., (Brooksville limekiln) produced primary lime for its first full year of operation; crushed limestone used in the operation was supplied by Camp Concrete Rock Co.

Hillsborough.—Ranking second in value of mineral production, the county moved from third rank in 1961; the county was also third in crushed oystershell and second in peat production. Other commodities produced were land-pebble phosphate, portland and masonry cement, and industrial sand. American Cyanamid Co. (Sydney mine) and American Agricultural Chemical Co. (Boyette mine) mined land-pebble phosphate; output and value of both mines increased, compared with 1961. General Portland Cement Co. (Tampa mill) produced portland and masonry cement; output and value of both types decreased, compared with 1961. Bay Dredging and Construction Co. dredged oystershell from State leases 694 and 1703 for concrete and roadstone. Edgar Plastic Kaolin Co. produced building and industrial sand for the second year from its Plant City mine; output and value increased considerably, compared with 1961. Zonolite Co. (Tampa plant) and Verlite Co. exfoliated vermiculite at plants near

Tampa; the crude material was brought in from South Carolina, Montana, and South Africa. Peat was produced by A. J. Stearns, Seffner, and F. E. Stearns' Peat, Valrico, for soil conditioning and improvement.

Indian River.—Florida Minerals Co. (Vero mine) produced ilmenite, rutile, and zircon from beach sands. Indian River County Highway Department crushed limestone and produced sand for use in its highway maintenance program. Airlite Processing Corp. of Florida (Vero Beach plant) expanded crude perlite from Western States.

Jackson.—Green Valley Lime Co. (Marianna quarry), a new company reporting for the first year, and E. M. Fellows Lime Co. (Fellows quarry), formerly West Florida Lime Co. near Cottondale, crushed limestone for agricultural purposes. All material from both producers was transported by truck. A. B. Wililams Co. (Marianna mine), new sand producer reporting for the first year, mined a small tonnage of building and fill sand.

Lafayette.—Williston Shell Rock Co. (Chauncey and Dell quarries), crushed limestone for concrete, roadstone, and screenings; combined output from both quarries more than doubled that of 1961. All of the stone was transported by truck. The Lafayette County Highway Department mined 13,000 tons of sand, valued at $19,000, for use in highway maintenance.

Lake.—Three companies mined building sand, compared with five in 1961. Central Sand Co. (Tavares mine) went out of business late in 1961, and Oakland Sand & Mineral Corp. (Clermont mine) reported 1 year and went out of business the next. Producers listed in order of output were E. R. Jahna Industries, Inc., (Clermont mine), third leading sand producer in the State; Eustis Sand Co. (Eustis mine); and Silver Lake Estates (Leesburg mine); all of the sand was transported by truck.

Lee.—West Coast Rock Co. (Fort Myers quarry) crushed limestone for use in concrete, roadstone, and screenings and transported all of the stone by truck. Oystershell was dredged by two companies on leases obtained from the State. Edison Shell Co., the leading producer, operated on two leases (1504 and 1684), and Fort Myers Shell Co. produced from a single lease (1344); the shell was used primarily for road construction and was transported by truck.

Leon.—Three companies mined building sand compared to only two in 1961. Producers, listed in order of output, were Asa Maige Sand Co. (Norfleet mine), Johnson Sand Co. (Norfleet mine), and Middle Florida Sand Co. (Tallahassee mine). All of the material was transported by truck. Output and value of the combined operations more than doubled those of 1961.

Levy.—Limestone was crushed by three companies for use in concrete and roadstone and screenings and by two for agricultural purposes. Producers, listed in order of output, were Connell & Shultz (Williston quarry); W & M Construction Co. (Raleigh quarry), reporting for the first year since 1960; Dixie Lime & Stone Co. (Lebanon No. 4 quarry), agricultural limestone; United Limerock Co. (No. 2 Williston quarry), which became an affiliate of Shands & Baker during the year; and Ralph Swiney (Miller quarry), agricultural limestone. Combined output of the five operations was 526,000 tons valued at $668,000, decreases of 1 percent in tonnage and 23 percent

in value, compared with 1961; 93 percent of the stone was transported by truck; the remainder, by railroad.

Manatee.—Florida-Southern Dolomite, Ltd. (Palmetto quarry), formerly Southern Dolomite Co., crushed limestone for agricultural purposes. Florida-Southern completed and placed into operation a new $500,000 quarry and plant, increasing output considerably from that of 1961. Bradenton Dredging and Shell Co. (lease 1585) dredged a small tonnage of oystershell for use in road construction. The company reported that it was discontinuing dredging operations, but it would continue supplying oystershell dredged by other companies.

Marion.—Four companies crushed limestone, one produced primary lime, and one company mined soft-rock phosphate. Total crushed stone output was 1.1 million tons valued at $1.2 million, a decrease of 17 percent in tonnage and 4 percent in value from 1961; 59 percent of the stone was transported by truck, 31 percent by railroad, and the remainder by waterway. Producers, listed in order of output, were Ocala Lime Rock Corp. (No. 7 Kendrick quarry), Dixie Lime and Stone Co. (Kendrick No. 3 quarry), Cummer Lime & Mfg. Co. (Kendrick quarry), and Southern Materials Corp. (Lowell quarry), a new producer reporting for the first year. Dixie Lime and Stone Co. (Ocala No. 1 limekiln) produced quicklime and hydrated lime for building and chemical purposes. Marion County Highway Department crushed 77,000 tons of limestone, valued at $42,000, for use in road maintenance. The Loncala Phosphate Co. (Minehead mines and plant) mined and processed soft-rock phosphate; the company operated in the county for the second consecutive year.

Monroe.—Charley Toppino & Sons, Inc. (Stock Island quarry) crushed limestone for concrete, roadstone and screenings, and fill purposes; 275,000 tons of stone, valued at $276,000 was crushed, a slight decrease, compared with 1961. Key Marble Co., only dimension limestone producer reporting in 1961, went out of business.

Nassau.—Container Corp. of America (Fernandina limekiln) reported regenerated lime production for use in pulp and paper. This was the first year that this company reported secondary lime output.

Orange.—The county, for the second consecutive year, ranked first in peat production. Daetwyler Peat Mine, Orlando, mined reed-sedge peat, and Raymond Johnson of Plymouth mined humus peat near Zellwood and sold it in bulk for soil improvement purposes. Orange County Highway Department mined 150,000 tons of sand, valued at $100,000; the sand, all transported by truck, was used for highway maintenance.

Palm Beach.—Belle Glade Rock Co. (Belle Glade quarry) crushed limestone for concrete and roadstone and screenings; output and value increased over 1961. Palm Beach County Highway Department crushed 87,000 tons of limestone, valued at $78,000, for use in highway maintenance and mined a small tonnage of sand for the same purpose. Zonolite Co. (Boca Raton plant) exfoliated crude vermiculite from out-of-State sources.

Pasco.—Port Richey Mining Corp. (Hudson quarry) crushed limestone for concrete, roadstone and screenings, and fill. Output and value decreased, compared with 1961; all of the stone was transported

by truck. Camp Concrete Rock Co. (Ivy quarry) did not report any production for the year; it was assumed to be out of business.

Pinellas.—Pinellas County Highway Department mined 5,400 tons of sand, valued at $6,000, for use in highway maintenance. Benton and Co. dredged oystershell on two State leases (460 and 1788) for use in concrete and road construction; total output was 405,000 tons, valued at $490,000, showing considerable increases over 1961 figures.

Polk.—The county, ranking first in value of mineral production and the leading producer of phosphate rock and sand and gravel, continued to furnish 48 percent of the total State value—$88 million, compared with $89 million in 1961. Marketable land-pebble phosphate rock output was 12.7 million tons, valued at $86 million, showing a slight decrease in value from 1961; total sand output was 2.2 million tons, valued at $1.7 million, showing decreases of 12 and 15 percent, respectively, from 1961. Land-pebble phosphate rock producers, listed in order of output, were International Minerals and Chemical Co. (Achan and Noralyn mines); Virginia Carolina Chemical Co. (Clear Springs and Homeland mines); American Agricultural Chemical Co. (Palmetto and South Pierce mines); Davison Chemical Division, W. R. Grace & Co. (Bonny Lake mine); American Cyanamid Co. (Orange Park mine); Swift & Co. (Varn, Watson, and Silver City mines); Smith-Douglass Co., Inc. (Tenoroc mine); Armour Agricultural Chemical Co. (Armour mine); and New Concept Co. (Green Bay mine).

Total sand output came from 9 mines, compared with 10 in 1961; 2.2 million tons of sand, valued at $1.7 million, was mined. Seventy-five percent of the sand was transported by railroad, 13 percent by truck, and the remainder by waterway. Producers, listed in order of output, were Standard Sand and Silica Co. (Standard mine) and Mammoth Sand Co. (Lake Wales mine), the two largest producers in the State; Oak Ridge Sand Co., Inc. (Achan mine); Lake Wales Sand Co., Inc., (Lake Wales mine) formerly Gall Silica Mining Co, Inc.; Lake Wales Concrete Sand Co. (Lake Wales mine); Lake Wales Independent Sand Co., Inc., (Independent mine); Polk City Sand Co. (Polk City mine); Davenport Sand Co., Inc., (Mammoth mine); Superior Sand Co., Inc., (Winter Haven mine); and Waverly Road Sand Co. (Winter Haven mine). The sand was used for building, paving, and industrial uses.

Putnam.—The county again was the third ranking county in output of sand and gravel, fourth in output of peat, and the only kaolin-producing county in the State. Total output of sand, 684,000 tons, valued at $580,000, came from 8 mines. Producers, listed in order of output, were: Diamond Interlachen Sand Co., Inc., (Keuka mine); formerly Keuka Sand Co. (Putnam County mine); Diamond Interlachen Sand Co., Inc., (Interlachen mine); Southern Materials Co. of Florida (Putnam Hall mine); Edgar Plastic Kaolin Co. (Edgar mine); Keystone Sand Co., Inc., (Grandin mine); United Clay Mines Corp. (Crossley mine); Wright Engineering Corp. (Interlachen mine); and Chesser & Strickland Sand Co. (Hollister mine). Edgar Plastic Kaolin Co. (Edgar mine) and United Clay Mines Corp. (No. 4 mine) produced kaolin clay for pottery, stoneware, floor and wall tile, clay crucibles, and other uses. Hudson Pump and Paper Corp. (Palatka limekiln) produced regenerated quicklime for use in pulp

and paper. This was the first year that this company reported its secondary lime output. Traxler's Peat Co., Florahoma, mined humus peat for use as a soil conditioner.

St. Lucie.—Ft. Pierce Sand and Materials Co. (Ft. Pierce mine) mined building sand and reported production of building and fill sand from a new operation (White City mine); combined output of both operations was more than in 1961. All of the material was transported by truck.

Sarasota.—Florida Dolomite Co. (Florida Dolomite quarry), now Florida-Southern Dolomite, Ltd., Manatee County, produced crushed limestone during the first quarter for agricultural uses. A new plant was constructed by the company in Manatee County and will supply material for agricultural uses. West Coast Dolomite, Inc., (Venice quarry), formerly West Coast Rock Co., reorganized during the year and was constructing an agricultural limestone plant near the old plant site. Production during the year consisted of crushed limestone for concrete, roadstone and screenings, and agricultural purposes. The new plant will process agstone.

Sumter.—Dixie Lime and Stone Co. (Sumterville quarry), third largest crushed stone operation in the State, crushed limestone for concrete, and roadstone and screenings; tonnage and value decreased slightly, compared with 1961. Nobleton Rock Co. (Nobleton quarry) crushed limestone for concrete and roadstone and screenings. Florida Superior Rock Corp. (Wade and Istachata quarries) went out of business early in the year. Eighty-one percent of the total stone was transported by railroad; the remainder, by truck.

Suwannee.—The county had the second largest crushed limestone operation in the State; Florida Rock Products Corp. (Suwannee quarry) crushed limestone for concrete and roadstone and screenings; output increased considerably, compared with 1961. Dixie Lime and Stone Co. (Mulkey quarry), reporting for the first year, crushed limestone for concrete and roadstone. Suwannee Dolomite and Lime Co. (Live Oak quarry), formerly Suwannee Valley Dolomite, Inc., crushed limestone for agricultural purposes; output and value increased considerably, compared with 1961. Fifty-nine percent of the total stone was transported by railroad; the remainder, by truck.

Taylor.—Buckeye Cellulose Corp. (Foley limekiln) recovered regenerated lime for use in water purification and softening, and for causticizing. The material was reclassified as secondary lime for the first year; previously it had been classified as primary lime.

Volusia.—White Sand and Materials Co. (New Smyrna Beach mine) and Houser Concrete Co. (Deland mine) produced building sand; combined output and value increased, compared with 1961.

Walton.—For the second consecutive year the county led in oystershell production. Radcliff Materials, Inc., dredged oystershell from 2 State leases (753 and 1718). The material was used primarily for road construction and in manufacturing lime. Adams Sand Co. (Mossy Head mine), a new producer reporting for the first year, mined 28,000 tons of building sand.

Washington.—Miller and Jerkins (Wausau mine) reported building sand output for its second year; output and value decreased, compared with 1961.

The Mineral Industry of Georgia

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Georgia for collecting information on all minerals, except fuels.

By James L. Vallely [1] and Garland Peyton [2]

MINERAL PRODUCTION in Georgia continued its long, steady trend upward, and for the first time value exceeded $100 million, increasing 12 percent from $96.3 million in 1961 to $107.7 million. Cement, kaolin, and crushed stone were primarily responsible for the increase. Bauxite, fuller's earth, miscellaneous clay, feldspar, iron ore, and sand and gravel also showed substantial gains. Barite, although higher in tonnage, was slightly lower in value. Mica, sheet and scrap, talc, manganiferous ore, and peat were all lower in tonnage and value.

Clays comprised 44 percent of the total State production value, stone 39 percent, and sand and gravel 3 percent.

Georgia ranked first among the States in output of kaolin, second in fuller's earth, and fourth in barite and feldspar. Georgia also was first in output of granite and marble, both crushed and dimension, and crushed slate.

TABLE 1.—Mineral production in Georgia [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite thousand short tons	107	$2,046	109	$1,987
Clays do	3,569	42,025	3,801	47,462
Coal (bituminous) do	4	22	8	28
Feldspar thousand long tons	31	692	36	795
Gem stones	[2]	[3]	[2]	[3]
Iron ore (usable) thousand long tons, gross weight	162	835	215	1,118
Mica, sheet pounds	349	3	60	1
Sand and gravel thousand short tons	3,150	3,049	3,429	3,365
Stone do	15,854	38,077	19,555	42,037
Talc and soapstone short tons	47,950	98	45,940	96
Value of items that cannot be disclosed: Bauxite, cement, manganiferous ore, mica (scrap), and peat		[4] 9,464		10,816
Total		96,311		107,705

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $500.
[4] Revised figure.

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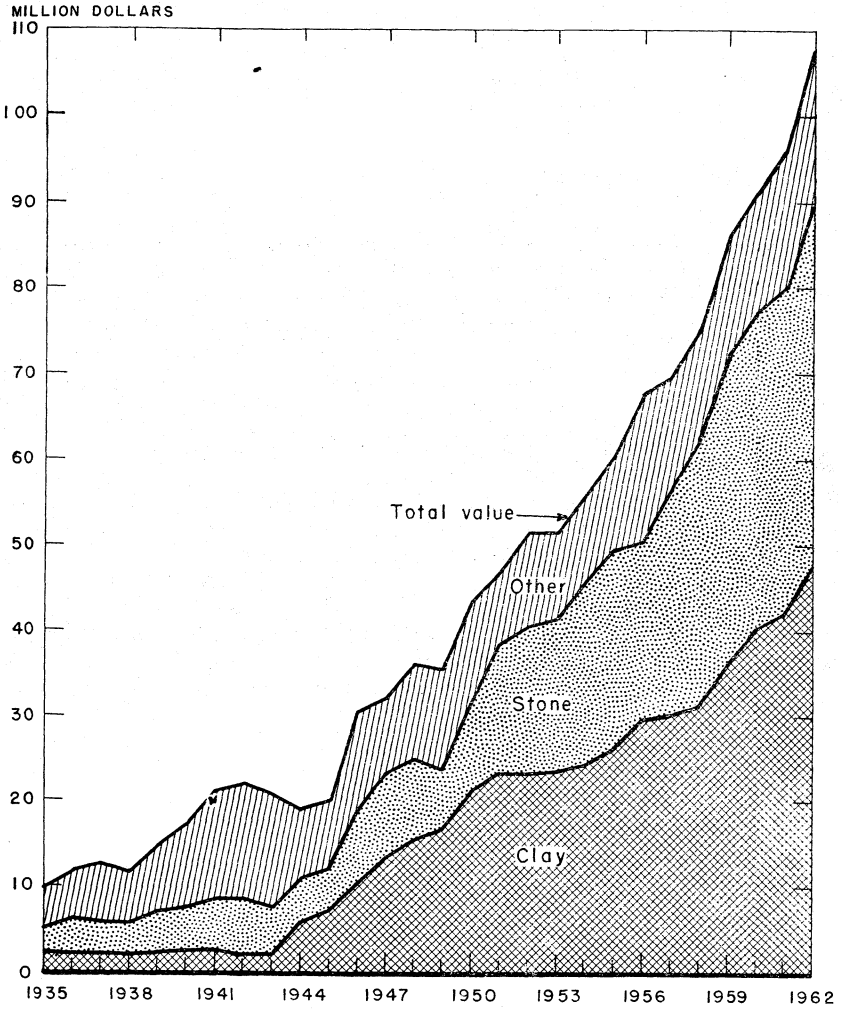

FIGURE 1.—Value of clays and stone, and total value of mineral production in Georgia, 1935–62.

Employment and Injuries.—Preliminary figures for 1962 indicated that employment in the mineral industries was much lower than in 1961.

Active operations numbered 193, compared with 200 in 1961, and the number of days worked increased from 261 to 277. Taking into consideration the greater accuracy of the canvass, the greater output of most minerals, the increased number of days worked, and

the small decrease in active operations (mostly small mica mines), it appears that actual employment for 1962 was at least equal to that of 1961.

Five fatal accidents were recorded (four in quarries and mills and one in nonmetal mines and mills), compared with only one (nonmetal mines and mills) in 1961.

Nonfatal accidents declined from 379 to 323 with a slight rise in the overall injury-frequency rate from 24 to 25 per million man hours.

TABLE 2.—Employment and injuries in the mineral industries

Year and industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:							
Nonmetal mines and mills	69	3,929	270	8,540,928	1	188	22
Quarries and mills	74	3,139	254	6,538,994		176	27
Sand and gravel mines	35	356	253	787,295		14	18
Metal mines and mills	20	85	126	86,012		1	12
Coal mines	2	8	69	4,426			
Total	200	7,517	261	15,957,655	1	379	24
1962:[1]							
Nonmetal mines and mills	59	2,628	297	6,247,788	1	149	24
Quarries and mills	78	2,838	264	5,996,222	4	156	27
Sand and gravel mines	38	329	261	686,315		17	25
Metal mines and mills	16	89	172	122,572		1	8
Coal mines	2	11	207	18,224			
Total	193	5,895	277	13,071,121	5	323	25

[1] Preliminary figures.

Trends and Developments.—The Interstate and Defense Highway System contributed in a marked degree to the improvement of the mineral industry of Georgia in 1962. On June 30, 193.4 miles of interstate highway were under construction, and 35.4 additional miles had been completed during fiscal year 1962. Primary and secondary highway projects completed during the same period added 402.8 miles to the total. Several new quarries to produce aggregate principally for the highway system were opened. Merger of quarrying companies in 1961 had brought together two Georgia producers with four quarries, and three Florida companies to form Dixie Lime & Stone Co.

Southern Cement Co.'s new cement manufacturing plant at Atlanta was still under construction at the end of 1962; two cement distribution terminals (Atlanta and Savannah) were built during the year, and at Atlanta one distribution terminal was under construction and a site acquired for a fourth.

Other new operations included a kyanite mine and mill at Lincolnton, and a flotation plant to recover feldspar from crushed granite at Lithonia.

Construction was started on the $40 million Carters Dam project on the Coosawatte River between Cartersville and Chatsworth; the Columbia Lock and Dam on the Chattahoochie was nearing completion, and construction of the powerplant at the Hartwell Dam was underway.

Legislation and Government Programs.—Purchase of mica by the General Services Administration (GSA) was discontinued on June 7, when the quota of 25,000 tons of hand-cobbed mica or its equivalent in trimmed mica (90 pounds of trimmed mica equals 1 short ton of hand cobbed) was filled, less than 1 month before the final date, as prescribed by Public Law 520. No Office of Mineral Explorations contracts were in force.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Primary barite production, all from Bartow County, increased 2 percent in tonnage but decreased 3 percent in value. Primary barite was shipped principally for barite chemicals and glass manufacture, and crushed and ground barite for rubber and well drilling uses. Leading producers were Paga Mining Co. and New Riverside Ochre Co.

Cement.—Shipments of both masonry and portland cements were higher in quantity and value. Total cement shipments were 10 percent and 13 percent higher, respectively, in quantity and value. Out-of-State shipments were principally to Florida, with smaller tonnages to Alabama, North Carolina, South Carolina, and Tennessee. More than two-thirds of the shipments went to ready-mixed concrete and concrete products manufacturing companies, the remainder to highway and other contractors, dealers, government agencies, and miscellaneous customers.

Marquette Cement Manufacturing Co. produced portland and masonry cements at Rockmart, and Penn-Dixie Cement Corp. manufactured portland cement at Clinchfield. The new plant of Southern Cement Co. at Atlanta was still under construction at yearend. At Atlanta, a cement distribution terminal was completed, another under construction, and a site acquired for a third. One was also completed at Savannah. Expansion of Penn-Dixie's plant was described.[3]

Clays.—First in value of mineral production, clay accounted for 44 percent of the State total, unchanged from 1961. Kaolin and fuller's earth each rose 6 percent in tonnage with increases of 13 and 15 percent, respectively, in value. Miscellaneous clay increased 7 percent in tonnage and 10 percent in value.

Georgia continued to lead the Nation in kaolin production and ranked second in fuller's earth. Nineteen companies mined kaolin from 22 pits in 8 counties (Baldwin, Floyd, Macon, Richmond, Sumter, Twiggs, Washington, and Wilkinson); 5 companies produced fuller's earth in Decatur, Jefferson, Thomas, and Twiggs Counties; and 15 companies mined miscellaneous clay in 11 counties. Leading producers of kaolin were Kaolin-American Industrial Clay Co., Georgia Kaolin Co., J. M. Huber Corp., Minerals & Chemicals Phillip Corp., United Clay Mines Corp., Southern Clays, Inc., and Thiele Kaolin Co. Leading producers of fuller's earth were Cairo

[3] Pit and Quarry. Penn-Dixie's Georgia Plant Expansion, v. 55, No. 2, August 1962, pp. 84–89.

Production Co., Diversey Corp., Georgia-Tennessee Mining & Chemical Co., Milwhite Co., and Waverly Petroleum Products Co.; and of miscellaneous clay, Burns Brick Co., Chattahoochee Brick Co., Cherokee Brick Co., Merry Bros. Brick & Tile Co., and Oconee Clay Products Co.

TABLE 3.—Kaolin and fuller's earth sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Baldwin	(1)	(1)	(1)	(1)
Decatur	(1)	(1)	(1)	(1)
Floyd	(1)	(1)	(1)	(1)
Grady	(1)	(1)		
Jefferson	19,100	$362,327	(1)	(1)
Macon	(1)	(1)	(1)	(1)
Richmond	81,029	641,838	77,806	$608,060
Sumter	(1)	(1)	(1)	(1)
Thomas	(1)	(1)	(1)	(1)
Twiggs	1,089,253	22,335,073	1,151,868	24,208,460
Washington	666,636	13,109,268	769,036	16,142,840
Wilkinson	(1)	(1)	(1)	(1)
Other counties	392,110	4,995,042	386,686	5,863,267
Total	2,248,128	41,443,548	2,385,396	46,822,627

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

Feldspar.—The Feldspar Corp. mined feldspathic rock at various locations in Jasper County and produced a feldspar flotation concentrate for use in glass and pottery manufacture at its mill near Monticello. Consolidated Quarries, a division of Georgia Marble Co., completed a plant at its granite quarry near Lithonia to recover a feldspar-quartz product from fines of the crushing plant.

Gem Stones.—Small quantities of amethyst, kyanite, and rutile were collected in Lincoln and Towns Counties and were valued at less than $500.

Gypsum.—Bestwall Gypsum Co. (Brunswick plant) and National Gypsum Co. (Savannah plant) calcined imported gypsum and manufactured wallboard and other gypsum products.

Kyanite.—Aluminum Silicates Co. erected a mill, and mine development was underway at Graves Mountain near Lincolnton, Lincoln County.

Lime.—Production of regenerated lime was canvassed for the first time by the Bureau of Mines in 1962. This lime is produced and reused principally by pulp and paper companies by burning calcium carbonate sludge in rotary kilns. In 1962 six companies in Georgia produced 263,000 tons valued at $4.9 million. Data on regenerated lime are not included in table 1 of this chapter. No primary lime has been produced in Georgia since 1954.

Mica.—Only 60 pounds of sheet mica valued at less than $1,000 was produced and sold through the GSA mica depot at Spruce Pine, N.C. With the closing of the depot in June, it became uneconomical for domestic producers to operate and compete with cheaper foreign sheet mica. Scrap mica production from Cherokee and Hart Counties decreased 19 percent in tonnage and 34 percent in value.

TABLE 4.—Kaolin sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Pottery and stoneware:						
Whiteware	80,563	$1,531,428	$19.01	81,982	$1,626,884	$19.84
Art pottery, etc	(1)	(1)	(1)	3,245	57,419	17.69
Floor and wall tile	8,927	145,996	16.35	(1)	(1)	(1)
Refractories:						
Firebrick and block	193,834	1,343,516	6.93	163,709	1,259,646	7.69
Fire-clay mortar				(1)	(1)	(1)
Fillers:						
Paper filling	567,248	10,755,017	18.96	577,764	11,417,028	19.76
Paper coating	879,107	18,771,820	21.35	967,491	21,705,468	22.43
Rubber	105,094	1,335,956	12.71	100,929	1,339,884	13.28
Paint	50,304	985,895	19.60	46,850	987,320	21.07
Fertilizers	6,283	114,818	18.27	7,579	136,623	18.03
Insecticides and fungicides	(1)	(1)	(1)	7,898	98,045	12.41
Chemicals	(1)	(1)	(1)	20,930	328,824	15.71
Exports	72,396	1,621,760	22.40	89,128	2,037,156	22.86
Other uses [2]	183,422	2,950,916	16.09	210,779	3,660,972	17.37
Total	2,147,178	39,557,122	18.42	2,278,284	44,655,269	19.60

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[2] Includes stoneware (including chemical stoneware); enameling; bauxite (high-alumina brick); glass refractories; foundries and steelworks; saggers, pins, stilts, and wads; other refractories; linoleum and oilcloth; organic plastics; other fillers; portland and other hydraulic cements; catalysts; other uses and uses indicated by footnote 1.

TABLE 5.—Miscellaneous clay sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Bibb	(1)	(1)	(1)	(1)
Columbia	(1)	(1)	(1)	(1)
Crawford	300	$125	(1)	(1)
Floyd	(1)	(1)	(1)	(1)
Fulton	(1)	(1)	(1)	(1)
Gordon	24,180	10,400	27,465	$12,100
Houston	(1)	(1)	(1)	(1)
Polk	(1)	(1)	(1)	(1)
Richmond	(1)	(1)	569,825	250,700
Walker	80,000	31,500	(1)	(1)
Whitfield	(1)	(1)	4,400	1,950
Other counties	1,216,201	539,117	813,850	374,779
Total	1,320,681	581,142	1,415,540	639,529

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

Sand and Gravel.—Sand and gravel ranked fourth in value in the State's mineral production. Total output increased 9 percent and value increased 10 percent. Sand made up more than 90 percent of the total, increasing 8 percent in tonnage and 9 percent in value, while gravel rose 18 percent in tonnage and 22 percent in value. Structural sand was higher by 4 percent in quantity and 5 percent in value, and paving sand decreased 3 and 7 percent, respectively, in tonnage and value. Blast, glass, molding, and other sands also increased, but filler and ground sand were lower. Structural gravel increased 46 percent in both tonnage and value, but paving gravel decreased 48 percent.

Twenty-nine companies produced sand only from 34 pits in 26 counties, and 5 companies produced both sand and gravel in 4 counties. Bibb, Crawford, Effingham, Muscogee, Talbot, Taylor, and Thomas were the principal producing counties. Atlanta Sand & Supply Co. (Crawford County); Brown Bros. Sand Co. and Taylor Sand Co. (Talbot County); J. J. Brown Sand & Gravel Co. and Calhoun Sand & Gravel Co. (Muscogee County); Dawes Silica Mining Co. (Dougherty, Effingham, Long, and Thomas Counties); and Howard Sand Co. (Taylor County) were the principal producers.

TABLE 6.—Sand and gravel sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Brooks	214,376	$210,402	101,393	$108,519
Chattooga	1,410	3,172	1,675	3,936
Cook			91,000	97,591
DeKalb	18,900	21,000	(1)	(1)
Dougherty	227,819	191,392	167,048	151,029
Elbert	8,926	6,070	86	740
Evans	8,305	12,457	10,000	15,000
Fulton	66,351	50,546	(1)	(1)
Montgomery	22,680	22,680	21,600	16,000
Sumter	25,000	17,000	(1)	(1)
Taylor	326,975	172,185	(1)	(1)
Telfair	10,250	6,970	10,500	10,500
Tift			22,000	19,500
Walker			18,317	24,966
Ware	20,792	28,000	(1)	(1)
White			9,800	10,568
Undistributed [2]	2,198,062	2,306,826	2,975,629	2,906,179
Total	3,149,846	3,048,700	3,429,048	3,364,528

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes Bibb, Camden, Chatham, Crawford, Effingham, Glynn, Greene (1962), Long, Muscogee, Richmond, Talbot, Thomas, Towns (1962) Counties, and counties indicated by footnote 1.

Stone.—In second place in value of State mineral production was stone. Total output of all stone increased 23 percent in tonnage and 10 percent in value; crushed stone, comprising more than 98 percent of the total tonnage but less than 80 percent of the value, was up 24 percent in tonnage and 15 percent in value, whereas dimension stone decreased 2 percent in both tonnage and value. Granite, limestone, sandstone, and slate were higher in both tonnage and value; crushed marble increased in tonnage but declined in value, and dimension marble was down in both tonnage and value.

Stone was produced from 79 quarries in 33 counties by 54 company and Government-and-contractor operations. Dimension granite was produced in 6 counties and 31 quarries by 26 companies; crushed granite, in 17 counties from 22 quarries by 11 companies; and crushed limestone, in 8 counties and 12 quarries. Crushed and dimension marble was produced in Pickens County, and crushed marble, only in Gilmer County. Crushed slate was mined in Bartow and Polk Counties, quartzite in Richmond County, crushed sandstone in Polk County, and byproduct quartz in Jasper County. Leading producers of crushed granite were Dixie Lime & Stone Co., Stockbridge Stone Division of Vulcan Materials Co., and Weston & Brooker Co.; and of dimension granite, Coggins Granite Industries,

Inc., Comolli Granite Co., and Davidson Granite Co., Inc. Georgia Marble Co. produced crushed and dimension marble, and Marble Products Co. produced crushed marble only. Excluding the cement companies, the principal crushed limestone producers were Bridgeboro Lime & Stone Co., Dalton Rock Products Co., Georgia Limestone Co., and Ready-Mix Concrete Co. Superior Stone Co., divison of Martin Marietta Corp., was the only producer of quartzite. Funkhouser Mills Division of The Ruberoid Co. and Georgia Lightweight Aggregates Co. mined and crushed slate, respectively, for roofing granules and lightweight aggregate.

TABLE 7.—Sand and gravel sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Structural sand	2,085,549	$1,514,082	$0.73	2,172,816	$1,590,185	$0.73
Paving sand	485,458	367,731	.76	470,560	340,612	.72
Molding sand	83,631	131,529	1.57	(1)	(1)	(1)
Railroad ballast sand	119	71	.60	76,168	75,941	1.00
Fill sand	(1)	(1)	(1)	47,992	35,588	.74
Filtration	13,865	31,615	2.28	(1)	(1)	(1)
Grinding and polishing sand	114	70	.61			
Other sand and gravel [2]	481,110	1,003,602	2.09	661,512	1,322,202	2.00
Total	3,149,846	3,048,700	.97	3,429,048	3,364,528	.98

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other sand and gravel."
[2] Includes glass, blast, and other sands; structural, paving, and other gravel; and uses indicated by footnote 1.

TABLE 8.—Crushed granite sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roadstone	9,924,965	$14,412,349	$1.45	12,885,655	$17,696,447	$1.37
Railroad ballast	500,743	684,461	1.37	823,279	934,034	1.13
Riprap	535,009	784,410	1.47	374,263	483 573	1.29
Other [1]	885,802	1,388,303	1.57	727,602	1,202,519	1.65
Total	11,846,519	17,269,523	1.46	14,810,799	20,316,573	1.37

[1] Includes stone sand, poultry grit, filter sand, and other uses.

TABLE 9.—Dimension granite sold or used by producers, by counties

County	1961			1962		
	Cubic feet	Short tons (equivalent)	Value	Cubic feet	Short tons (equivalent)	Value
DeKalb	916,035	76,138	$1,179,449	986,837	81,749	$1,285,718
Elbert	578,347	48,010	1,736,085	561,540	46,604	1,729,541
Hancock	26,270	2,180	39,406	25,913	2,151	38,869
Madison	174,795	14,508	436,987	184,618	15,323	461,545
Oglethorpe	(1)	(1)	(1)	(1)	(1)	(1)
Rockdale	(1)	(1)	(1)	(1)	(1)	(1)
Total	2,039,443	169,387	4,292,474	2,099,877	174,349	4,568,223

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Total."

TABLE 10.—Dimension granite sold or used by producers, by uses

Use	1961			1962		
	Cubic feet	Value		Cubic feet	Value	
		Total	Average per cubic foot		Total	Average per cubic foot
Rough monumental	897,027	$1,883,995	$2.10	834,088	$1,704,185	$2.04
Curbing and flagging	416,043	741,431	1.78	446,723	839,520	1.88
Dressed monumental	134,937	1,012,194	7.50	156,749	1,254,127	8.00
Other [1]	591,436	654,854	1.11	662,317	770,391	1.16
Total	2,039,443	4,292,474	2.10	2,099,877	4,568,223	2.18

[1] Includes rubble, rough construction (1961), and rough (1962) and dressed architectural stone.

TABLE 11.—Crushed limestone sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roadstone	971,842	$1,518,350	$1.56	1,290 284	$1,987,556	$1.54
Railroad ballast	3,234	4,689	1.45	(1)	(1)	(1)
Other [2]	825,244	1,335,849	1.62	1,002,156	1,589,650	1.59
Total	1,800,320	2,858,888	1.59	2,292,440	3,577,206	1.56

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes riprap, flagstone, cement, and uses indicated by footnote 1.

Talc and Soapstone.—Georgia Talc Co. produced crude talc from five mines in Murray County. Crude production decreased 4 percent in tonnage and 2 percent in value. Besides crayons, ground talc was prepared at the company mills in Chatsworth for asphalt filler, insecticides, roofing, rubber, and other uses.

Vermiculite.—Zonolite Co., Atlanta, exfoliated crude vermiculite shipped into the State.

METALS

Bauxite.—American Cyanamid Co., the only producer, mined crude bauxite in Floyd and Sumter Counties. Production was more than double that of 1961. Shipments were made to the company's Halls Station drying plant, Bartow County, and directly to consumers.

Iron Ore.—Shipments of brown iron ore were higher by 33 percent in tonnage and 34 percent in value, the average unit value increasing from $5.15 to $5.20 per ton. Eighty-five percent of the ore was mined in the Stewart-Webster-Dooly district south of the Fall Line and 15 percent in the Bartow-Polk County area in the northwestern part of the State. Leading producers were B & C Construction Co., Brown-Nugget Mining Co., and Davis Bros.

Crude iron oxide pigments increased 29 percent in tonnage and 19 percent in value, and finished pigments increased 11 and 12 percent, respectively, in tonnage and value. New Riverside Ochre Co. was the only producer.

Manganese.—Production and value of manganiferous ore (less than 35 percent manganese) continued to decline. Only one producer was active in Bartow County, and output dropped to slightly more than half that of 1961.

MINERAL FUELS

Coal (Bituminous).—Only one underground mine producing more than 1,000 tons was active. W. T. Blevins Coal Co. of Walker County produced 8,000 tons valued at $28,000.

Peat.—Humus peat was produced by two companies in Lowndes County and was used for agricultural and horticultural purposes principally.

REVIEW BY COUNTIES

Mineral production was reported from 76 counties compared with 71 in 1961. Twenty counties had production valued above $1 million and constituted 87 percent of the State total. The 11 leading counties, each having production exceeding $2 million, in descending order were Twiggs, Washington, Pickens, Houston, Polk, DeKalb, Wilkinson, Bartow, Muscogee, Richmond, and Jones.

Baldwin.—General Refractories Co. mined kaolin at the Wood mine for the manufacture of fire brick and block.

Bartow.—Value of mineral production decreased 2 percent; barite, crushed slate, brown iron, and manganiferous ores were lower, only crushed limestone and crude iron oxide pigments increased over 1961. Leading crude barite producers were B. R. Cain, Paga Mining Co., and New Riverside Ochre Co.; the last company was the only producer of crude and finished iron oxide pigments in the State. Thompson-Weinman & Co. operated a grinding plant at Cartersville to produce fillers and extenders from barite, kaolin, marble, mica, and other minerals. Marquette Cement Manufacturing Co. quarried limestone for use in its cement plant at Rockmart, and Funkhouser Mills Division of The Ruberoid Co. mined and crushed slate at its Fairmount mine for roofing granules and slate flour. Mosteller Bros. was the only producer of manganiferous ore and the principal pro-

ducer of brown iron ore. American Cyanamid Co. treated crude bauxite from Floyd and Sumter Counties at its Halls Station drying plant.

TABLE 12.—Value of mineral production in Georgia, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value
Baldwin	(2)	(2)	Kaolin.
Bartow	$3,178,800	$3,127,289	Barite, slate, limestone, iron oxide pigments, manganiferous ore, iron ore.
Bibb	324,272	312,900	Sand and gravel, miscellaneous clay.
Brooks	210,402	108,519	Sand and gravel.
Camden	(2)	(2)	Do.
Chatham	(2)	(2)	Do.
Chattooga	3,172	3,936	Do.
Cherokee	(2)	(2)	Mica.
Clarke	(2)	(2)	Granite.
Clayton	(2)	(2)	Do.
Cobb	(2)	(2)	Do.
Columbia	(2)	(2)	Miscellaneous clay.
Cook	----	97,591	Sand and gravel.
Crawford	(2)	(2)	Sand and gravel, miscellaneous clay.
Dade	(2)	(2)	Limestone.
Decatur	(2)	(2)	Fuller's earth.
DeKalb	(2)	(2)	Granite, sand and gravel.
Dooly	(2)	(2)	Iron ore.
Dougherty	191,392	151,029	Sand and gravel.
Douglas	(2)	(2)	Granite.
Effingham	(2)	(2)	Sand and gravel.
Elbert	1,742,155	(2)	Granite, sand and gravel.
Evans	12,457	15,000	Sand and gravel.
Fannin	192,304	(2)	Limestone.
Fayette	(2)	(2)	Granite.
Floyd	545,146	1,019,749	Bauxite, limestone, miscellaneous clay, kaolin.
Fulton	(2)	(2)	Granite, miscellaneous clay, sand and gravel.
Gilmer	1,296,508	(2)	Marble.
Glynn	(2)	(2)	Sand and gravel.
Gordon	10,400	12,100	Miscellaneous clay.
Grady	(2)	----	
Greene	----	(2)	Sand and gravel.
Gwinnett	(2)	(2)	Granite.
Hall	(2)	(2)	Do.
Hancock	(2)	(2)	Do.
Hart	(2)	(2)	Mica.
Henry	(2)	(2)	Granite.
Houston	(2)	(2)	Cement, limestone, miscellaneous clay.
Jasper	708,064	(2)	Feldspar, sandstone.
Jefferson	362,327	(2)	Fuller's earth.
Jones	(2)	(2)	Granite.
Lamar	(2)	(2)	Do.
Lincoln	----	15	Gem stones.
Long	(2)	(2)	Sand and gravel.
Lowndes	(2)	(2)	Peat.
Lumpkin	----	(2)	Mica.
Macon	(2)	(2)	Kaolin.
Madison	436,987	461,545	Granite.
Meriwether	----	(2)	Mica.
Mitchell	(2)	(2)	Limestone.
Montgomery	22,680	16,000	Sand and gravel.
Murray	124,100	95,600	Talc, soapstone, slate.
Muscogee	2,596,740	(2)	Granite, sand and gravel.
Oconee	----	(2)	Mica.
Oglethorpe	693,211	745,076	Granite
Pickens	(2)	(2)	Marble, sandstone.
Polk	(2)	(2)	Cement, iron ore, slate, miscellaneous clay, sandstone.
Pulaski	(2)	----	
Rabun	(2)	(2)	Granite, mica.
Richmond	(2)	(2)	Sandstone, kaolin, miscellaneous clay, sand and gravel.
Rockdale	(2)	(2)	Granite.
Stewart	(2)	(2)	Iron ore.
Sumter	(2)	(2)	Bauxite, kaolin, sand and gravel.
Talbot	(2)	(2)	Sand and gravel.
Taylor	172,185	(2)	Do.
Telfair	6,970	10,500	Do.
Thomas	(2)	(2)	Fuller's earth, sand and gravel.
Tift	----	19,500	Sand and gravel.
Towns	----	(2)	Sand and gravel, gem stones.
Troup	10	----	

See footnotes at end of table.

TABLE 12.—Value of mineral production in Georgia, by counties[1]—Continued

County	1961	1962	Minerals produced in 1962 in order of value
Twiggs	$22,335,073	$24,208,460	Kaolin, fuller's earth.
Upson	(2)		
Walker	193,630	761,747	Limestone, miscellaneous clay, coal, sand and gravel.
Ware	28,000	(2)	Sand and gravel.
Warren	(2)	(2)	Granite.
Washington	13,109,268	16,142,840	Kaolin.
Webster	249,300	(2)	Iron ore.
White		10,568	Sand and gravel.
Whitfield	(2)	(2)	Limestone, miscellaneous clay.
Wilkinson	(2)	(2)	Kaolin.
Undistributed	[3] 47,565,457	60,384,801	
Total	[3]96,311,000	107,705,000	

[1] The following counties are not listed because no production was reported: Appling, Atkinson, Bacon, Baker, Banks, Barrow, Ben Hill, Berrien, Bleckley, Brantly, Bryan, Bullock, Burke, Butts, Calhoun, Candler, Carroll, Catoosa, Charlton, Chattahoochee, Clay, Clinch, Coffee, Colquitt, Coweta, Crisp, Dawson, Dodge, Early, Echols, Emanuel, Forsyth, Franklin, Glascock, Habersham, Haralson, Harris, Heard, Irwin, Jackson, Jeff Davis, Jenkins, Johnson, Lanier, Laurens, Lee, Liberty, McDuffie, McIntosh, Marion, Miller, Monroe, Morgan, Newton, Paulding, Peach, Pierce, Pike, Putman, Quitman, Randolph, Schley, Screven, Seminole, Spalding, Stephens, Taliaferro, Tattnall, Terrell, Toombs, Treutlen, Turner, Union, Walton, Wayne, Wheeler, Wilcox, Wilkes, and Worth.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Revised figure.

Bibb.—Burns Brick Co. and Cherokee Brick & Tile Co. mined miscellaneous clay for manufacturing brick and other clay products. Cornell-Young Co. produced sand and gravel at the Macon and Warner-Robbins pits; Sand Suppliers, Inc., mined sand for building and paving.

Brooks.—Bannockburn Sand Co. mined building, paving, and fill sand near Valdosta.

Camden.—Gray Towing Co. produced building and filtration sands at Brunswick. St. Marys Kraft Corp. calcined papermill sludge and recirculated the lime in the mill process.

Chatham.—Fitzgerald-Montgomery Co. at Savannah was the only sand and gravel producer in the county. National Gypsum Co. calcined imported crude gypsum for use in its building products plant at Savannah. Continental Can Co. calcined papermill sludge to lime for recirculation in the pulp mill.

Chattooga.—Wolf Creek Sand Co. produced unwashed molding sand.

Cherokee.—Ben Jones mined scrap mica for grinding by Thompson-Weinman & Co.

Clarke.—Gainesville Stone Co. quarried and crushed granite for concrete and roadstone.

Clayton.—Tyrone Rock Products Co. became a division of Dixie Lime & Stone Co. and continued to operate the Clayton quarry for crushed granite.

Cobb.—Stockbridge Stone Division of Vulcan Materials Co. produced crushed granite for concrete and roadstone at the Kennesaw quarry.

Columbia.—Georgia Vitrified Brick & Clay Co. mined miscellaneous clay at the Compania mine for brick, pipe, and other clay products.

Cook.—Bannockburn Sand Co. reported initial production from the new Burneyhill mine for building, railroad, and fill uses.

Crawford.—Atlanta Sand & Supply Co. produced building, paving, grinding, polishing, railroad ballast, and other sands at the Rollo mine. Middle Georgia Pottery Co. mined miscellaneous clay at Lizella to manufacture art pottery.

Dade.—Dave L. Brown Co. quarried limestone at Morganville for concrete and roadstone.

Decatur.—The Milwhite Co. mined and processed fuller's earth at Attapulgus for clarifying and absorbent uses, insecticides and fungicides, portland and other cements.

DeKalb.—Tonnage and value of both crushed and dimension granite were higher than in 1961. Consolidated Quarries Division of Georgia Marble Co. and Stone Mountain Grit Co. quarried and crushed granite for concrete and roadstone, railroad ballast, stone sand, filler sand, and poultry grit. Stone Mountain Granite Corp. and J. T. Reagin quarried dimension granite for rubble, curbing, and flagging; Davidson Granite Co., Inc. quarried granite for dressed architectural and rough construction stone, rubble, and riprap. Stamps Sand Co. mined paving sand.

Dooly.—Armco Mining Co. and American Mines, Inc., produced brown iron ore.

Dougherty.—Albany Lime & Cement Co., Dawes Silica Mining Co., Musgrove Sand Co., and Quick Service Sand Co. mined building and paving sand.

Douglas.—Consolidated Quarries Division of Georgia Marble Co. quarried and crushed granite for concrete, roadstone, railroad ballast, and stone sand.

Effingham.—Dawes Silica Mining Co., Inc., produced building, blast, filter, molding sands, and fertilizer filler.

Elbert.—Thirteen companies operated 15 granite quarries, 12 of which produced rough monumental stone only, and three both rough and dressed monumental stone. Production decreased 3 percent from 1961. Coggins Granite Industries, Inc., Comolli Granite Co., Continental Granite Co., Inc., and Elberton Granite Industries, Inc., were the largest producers in terms of tonnage. In addition to the 13 companies with quarries, more than 50 other companies operated sawing, finishing, and polishing plants at Elberton. McLanahan Crushed Stone Co. quarried granite for concrete and road stone. Bond Sand & Gravel Co. mined a small tonnage of building sand.

Evans.—Evans Concrete Products Co. mined building and paving sand at Daisy.

Fannin.—Willingham-Little Stone Co., division of Georgia Marble Co., quarried and crushed limestone at Mineral Bluff for concrete, roadstone, and agstone.

Fayette.—Tyrone Rock Division of Dixie Lime & Stone Co. produced crushed granite for concrete, roadstone, and railroad ballast.

Floyd.—American Cyanamid Co. mined bauxite and kaolin from the New Holland mine. Ready-Mixed Concrete Co. quarried and crushed limestone for concrete, roadstone, railroad ballast, riprap, and agricultural stone; Floyd County Highway Department produced concrete and roadstone. Oconee Clay Products Co. mined shale for use in its clay products plant at Milledgeville.

Fulton.—Atlanta Brick & Tile Co. and Chattahoochee Brick Co. mined miscellaneous clay for use in manufacturing brick. Hitchcock Corp. and Stockbridge Stone Division of Vulcan Materials Co. crushed granite for concrete and roadstone. Ace Sand Co., W. J. Griffins, C. J. Ross, and Thompson Bros. Sand Co. mined building and paving sand for local use.

Gilmer.—Willingham-Little Stone Co., division of Georgia Marble Co., mined and crushed marble at the Whitestone and Gobel mines for terrazzo and other uses.

Glynn.—Gray Towing Co. mined building sand. Brunswick Pulp & Paper Co. calcined mill sludge to lime and recirculated the lime in the paper making process. Bestwall Gypsum Co. calcined imported crude gypsum for wallboard and other building materials.

Gordon.—Plainville Brick Co. mined shale for making brick at Plainville.

Greene.—L. C. Curtis & Sons, Inc., mined building and paving sand at Watkinsville.

Gwinnett.—Stockbridge Stone Division of Vulcan Materials Co. and the State Board of Corrections quarried and crushed granite for concrete and roadstone.

Hall.—Gainesville Stone Co. quarried and crushed granite for concrete and roadstone.

Hancock.—Middle Georgia Quarrying Co. produced dimension granite for rough monumental stone and Weston & Brooker Co. quarried and crushed granite for concrete and roadstone.

Hart.—Funkhouser Mills Division of The Ruberoid Co. mined mica schist and produced ground mica at Hartwell for roofing, joint cement, and wallboard. Payne Bros. mined a small quantity of sheet mica.

Henry.—Stockbridge Stone Division of Vulcan Materials Co. quarried granite for concrete, roadstone, and railroad ballast.

Houston.—Penn-Dixie Cement Corp. mined clay and limestone and manufactured portland cement at Clinchfield. Georgia Limerock Division of Dixie Lime & Stone Co. produced crushed limestone principally for agricultural use.

Jasper.—The Feldspar Corp. mined feldspathic rock from several locations and produced flotation grade feldspar and byproduct quartz at its Monticello mill.

Jefferson.—Georgia-Tennessee Mining & Chemical Co. mined and processed fuller's earth near Wrens for absorbent uses.

Jones.—Hitchcock Corp. (Gray quarry) and Weston & Brooker Co. (Ruby quarry) produced crushed granite for concrete, roadstone, and stone sand.

Lamar.—Tyrone Rock Products Division of Dixie Lime & Stone quarried granite at Yatesville for concrete and roadstone.

Lincoln.—Margaret Clark reported collecting a small quantity of rutile and kyanite as gem material.

Long.—Dawes Silica Mining Co., Inc., mined building sand at Ludowici.

Lowndes.—Owens-Illinois Glass Co. produced and recirculated lime by calcining pulp mill sludge at its paper mill at Valdosta. Georgia Peat Moss Co. and Lake Park Peat Moss Co. produced humus peat for horticultural and agricultural uses.

Lumpkin.—Carl F. Thomas mined a small quantity of sheet mica at the Tucker mine.

Macon.—American Cyanamid Co. mined kaolin at the Cavender bauxite mine.

Madison.—Coggins Granite Industries, Inc., quarried rough monumental stone at the Piedmont granite quarry.

Meriwether.—Continental Gem & Mineral Co. produced a small quantity of sheet and scrap from hand-cobbed mica.

Mitchell.—Bridgeboro Lime & Stone Co. quarried and crushed limestone for concrete, roadstone, and agricultural uses.

Montgomery.—R. W. Geiger mined paving sand at Mount Vernon.

Murray.—Georgia Talc Co. mined crude talc at five mines and marketed crayons and ground talc. The ground talc was used for asphalt filler, insecticides, roofing, rubber, and textiles.

Muscogee.—Brown Sand & Gravel Co., Inc., and Calhoun Sand & Gravel Co. mined sand and gravel for building and paving. Stockbridge Stone Division of Vulcan Materials Co. crushed granite at the Barin quarry north of Columbus for concrete and roadstone, railroad ballast, and riprap.

Oconee.—Carl F. Thomas mined a small quantity of sheet mica.

Oglethorpe.—Nine companies quarried dimension granite for rough and dressed monumental stone. Leading producers in terms of tonnage were American Granite Quarries, Inc., Dixie Granite Co., Elbert County Granite Co., Inc. (two quarries), and Hoover Granite Industries, Inc.

Pickens.—The county continued as the third ranking county in the State in value of mineral production. Georgia Marble Co. quarried dimension marble (Tate and Nelson Divisions) for dressed building and monumental stone and crushed marble (Calcium Products Division, New York mine, and Willingham-Little Stone Division, Cove Mountain mine) for whiting, terrazzo, and other uses. Marble Products Co. of Georgia also mined and crushed marble for whiting, terrazzo, and other uses.

Carl Johnson, Hardy Johnson, and North Georgia Stone Co. quarried sandstone for flagstone and rubble.

Polk.—Marquette Cement Manufacturing Co. produced portland and masonry cements at Rockmart from clay and sandstone mined in Polk County and limestone quarried in Bartow County by the cement company. Georgia Lightweight Aggregate Co. mined and expanded slate for lightweight aggregate at Rockmart. Gammage Mining Co. was the only producer of brown iron ore.

Rabun.—At Dillard, Rabun Quarries, Inc., quarried and crushed granite for concrete and roadstone. Wilma Bean produced a small quantity of sheet mica.

Richmond.—Albion Kaolin Division of Interchemical Corp. mined kaolin for refractories, fillers, chemicals, and other varied uses. Georgia-Carolina Brick & Tile Co., Georgia Vitrified Brick & Clay Co., and Merry Bros. Brick & Tile Co. mined miscellaneous clay for brick and other clay products. Superior Stone Co., division of Martin Marietta Corp., produced crushed quartzite for concrete and roadstone at the Dan quarry north of Augusta. Speer Sand & Gravel Co. produced both sand and gravel for building and paving

uses. Continental Can Co. calcined paper mill sludge to lime for recirculation through its mill at Augusta.

Rockdale.—Kelly Granite Co., Inc., quarried dimension granite for curbing, flagging, and rubble.

Stewart.—Brown-Nuggett Mining Co., Howell & Chandler, and Stewart Mining Co. mined brown iron ore west of Lumpkin.

Sumter.—American Cyanamid Co. mined bauxite from the Thigpen mine and kaolin from the Holloway mine. Americus Sand & Gravel Co. mined building sand.

Talbot.—Brown Bros. Sand Co. and Taylor Sand Co. produced building, paving, molding and other sands.

Taylor.—Butler Sand Co. and Howard Sand Co. mined building and paving sand.

Telfair.—Flanders Bros. mined building sand near Scotland.

Thomas.—Cairo Production Co. and Waverly Petroleum Products Co. mined and processed fuller's earth for absorbent uses. Dawes Silica Mining Co., Inc., mined building, glass, filter, ground, and other industrial sands.

Tift.—Quality Sand Co. mined building and paving sands at Tifton.

Towns.—Mauney Mining Co. produced building sand. J. M. Stoinoff collected amethyst gem specimens.

Twiggs.—The county continued to rank first in value of mineral production, totaling $24.2 million, a gain of 8 percent over 1961. Georgia Coating Clay Co., Georgia Kaolin Co., J. M. Huber Corp., and Southern Clays, Inc., mined and processed kaolin for all its many uses. Stephens Fire Brick Co. mined kaolin for use in manufacturing fire brick and block. The Diversey Corp. mined and processed fuller's earth for filtering and clarifying, and for absorbents, insecticides, fungicides, and other uses.

Walker.—W. T. Blevins Coal Co. was the only operator, producing more than 1,000 tons of bituminous coal in Georgia in 1962. Key-James Brick Co. mined shale for manufacturing brick at the Chattanooga, Tenn. plant. Consolidated Sand & Mining, Inc., was a new producer of building and paving sand. Georgia Limestone Co. and two new operators, Patton Rock Products Corp. and Rossville Stone Co., quarried and crushed limestone for concrete, agstone and roadstone.

Ware.—E. W. Pafford mined building sand near Waycross.

Warren.—Weston & Brooker Co. quarried and crushed granite at Camak for concrete, roadstone, and railroad ballast.

Washington.—The county ranked second in value of mineral production. Kaolin, the only mineral produced, was mined and processed by American Industrial Clay Co., Anglo-American Clays Corp., Champion Paper & Fibre Co., Minerals & Chemicals Phillip Corp., Thiele Kaolin Co., and United Clay Mines Corp. Among the many uses for kaolin are paper coating and filler, whiteware, tile, refractories, plastics, paint, rubber, fertilizer, and catalysts.

Wayne.—Rayonier, Inc., calcined sludge and recirculated the resulting lime in its cellulose plant at Jesup.

Webster.—B & C Construction Co. and Davis Bros. were the only brown iron ore producers in 1962.

White.—Helen Rock & Sand Co. mined sand and gravel for building use.

Whitfield.—Dalton Rock Products Co. quarried and crushed limestone for concrete, roadstone, and agricultural use. Dalton Brick & Tile Corp. mined clay for brick and other clay products.

Wilkinson.—Kaolin, the only mineral produced in the county, was mined by Evans Clay Co., M & M Clays Co., and Minerals & Chemicals Phillip Corp. principally for paper, paints, and rubber, and by Harbison-Walker Refractories Co., D. C. Hardie Clay Co., and Oconee Clay Products Co. for firebrick, block, and other refractories.

The Mineral Industry of Hawaii

This chapter has been prepared under a cooperative agreement for collecting mineral data between the Bureau of Mines, U.S. Department of the Interior, and the Hawaii Department of Land and Natural Resources.

By Roy Y. Ashizawa [1]

MINERAL output of Hawaii declined 1 percent in value to $14.8 million, despite a half-million-dollar gain in the value of cement shipments. Producers of portland cement on Oahu Island increased their shipments to 1.13 million barrels and captured practically all of the cement market in the State. Total consumption of cement by the construction industry in Hawaii was down 110,000 barrels from the 1.24 million barrels of local and mainland cement consumed in 1961. The combined value of stream and beach sand, stream gravel, and quarried stone produced for road base and concrete aggregate was $8.0 million, compared with $8.4 million in 1961. The use of volcanic cinder for construction and maintenance of plantation roads, particularly on Hawaii Island, also was less than in 1961.

Sugar mills and pineapple canneries increased demands for lime produced at plants on Oahu and Maui Islands. The yield of solar evaporated salt from sea water and demand for black coral gem material were appreciably higher. A substantial quantity of raw clay was mined by the new and only manufacturer of clay products.

TABLE 1.—Mineral production in Hawaii [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement—376-pound barrels	1,076,800	$5,574	1,128,304	$6,055
Gem stones	(2)	18	(2)	(3)
Lime—short tons	14,306	354	15,243	386
Pumice (volcanic cinder)—do	323,978	626	231,922	380
Salt—do	37	4	(3)	(3)
Sand and gravel—do	415,727	758	700,196	1,122
Stone—do	4,429,484	7,656	4,071,186	6,883
Values of items that cannot be disclosed: Clays (1962) and values indicated by footnote 3				18
Total		[4] 14,990		14,844

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Revised figure.

[1] Mineral specialist, Bureau of Mines, San Francisco, Calif.

707-634—63——22

Employment and Injuries.—Preliminary figures compiled by the Bureau of Mines under provisions of Public Law 87–300 (Sept. 26, 1961; 75 Stat. 640) showed that an average of 564 employees, excluding officeworkers, worked 946,000 man-hours in 1962, compared to the final figures of 711 employees who worked 1,287,000 man-hours in 1961. The losses in employment and man-hours were mainly at stone quarries. No fatal accidents occurred in the mineral industry, but 51 nonfatal lost-time injuries were reported, compared to 2 fatal and 46 nonfatal accidents in 1961.

Trends and Developments.—The construction boom which reached an unprecedented high in 1960 and slid somewhat in 1961, tapered off toward a slightly lower and more realistic level in 1962. This trend, predicted by leading economists in Hawaii, was reflected in the market for portland cement, structural concrete aggregate, and masonry lime, particularly on Oahu where more than 90 percent of the authorized construction in the State was located. The increase in building activity on the neighboring islands was not enough to offset the general decline.

Periodic dredging of deepwater harbors and clearing of offshore reefs continued to create surplus mineral materials in excess of quantities used in the immediate vicinity as fill for port facilities. These mountains of surplus coral limestone, sometimes amounting to more than a half-million cubic yards at a single location, were causing problems to Government disposal agents and consternation to commercial operators of coral limestone quarries with surplus stockpiles of fill material. Producers who were depending more heavily on State and Federal contracts were concerned over the rigid Government specifications which excluded from certain projects the use of crushed coral limestone, pukapuka bluestone (holey basalt), and coral stone sand, normally used for base course and as concrete aggregate for non-Government paving and building.

An exploratory drilling project, undertaken in mid-1961 by Hawaii Thermal Power Co. and Magma Power Co., to locate an underground source of live steam in the Puna rift, Hawaii Island, was discontinued. By this joint venture, the companies had hoped to find natural steam at sufficient pressure for use in generating low-cost electrical energy. Unfortunately, the project was not successful, apparently because of the porous nature of the underlying lava.

Bourlin Industries, Honolulu, announced plans for constructing a plant at Barbers Point, Oahu, to extract magnesia from sea water and produce magnesium carbonate to be used in creating marble-like textures in building tile and panels made with cement and sugarcane bagasse. Other intended products of the proposed magnesia plant included magnesium hydroxide, magnesium sulfate, magnesium chloride, magnesium oxide, and magnesium metal.

Legislation and Government Programs.—A comprehensive public land law, Act 32, was passed in the 1962 session of the State Legislature. Several provisions in Act 32 affected minerals and mining. Section 10 provided for classification of all public lands, including the following: "5. Quarry use. Lands having sufficient quantity and quality of rock, gravel and sand for purpose of commercial use." and "6. Mining use. Lands bearing sufficient quantity and quality of mineral products for purpose of commercial mining and use." Section 36 provided

that in all leases of public lands, mineral and metal rights shall be reserved to the State. Section 55 provided that the right to any mineral shall not be included in any lease, agreement, or sale, because such right was reserved to the State.

The results of metallurgical research on Hawaiian bauxite were published in a Bureau of Mines report which revealed that the American Bayer type digestion of the crude ore samples from Kauai, Maui, and Hawaii recovered 78.8, 73.1, and 70.0 percent of the total alumina, respectively.[2] These recoveries were increased to 82.8, 85.5, and 79.5 percent, respectively, by modifying the treatment, consisting essentially of calcination and weak caustic desilication to provide a residue, which was then treated with quicklime and digested in a strong caustic solution to extract the alumina.

A Geological Survey report stated that profitable mining of ferruginous bauxite deposits would require a cheap method of upgrading the bauxite or a new or modified method for extracting alumina.[3] Other unfavorable economic factors such as the high values of land, requirements for soil reclamation after mining, and lack of adequate power sources lessened the possibilities for the development of the deposits.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—The two cement plants on Oahu produced 1,140,000 barrels and shipped 1,128,000 barrels in 1962, eliminating further need for the importation of general-use portland cement from the U.S. mainland. Shipments of cement from the two plants were as follows: To ready-mixed concrete companies, 56 percent; to concrete-product manufacturers, 22 percent; to building material dealers, 18 percent; to government agencies and miscellaneous customers, 4 percent. Nearly 902,000 barrels was in bulk, and over 226,000 barrels was in paper bags. Both plants used extensive dust collection systems to comply with air pollution regulations. Closed circuit television monitored each critical step in the complex production of high-quality federally approved cement. The combined plant requirements of electrical energy, supplied by Hawaiian Electric Co., Ltd., amounted to nearly 29.5 million kilowatt-hours. Hawaiian Cement Corp. added a new gypsum storage silo and a clinker belt-conveyor to its cement plant at Barbers Point. Permanente Cement Co., Waianae, completed expansion of its cement distribution facility at Pier 32, Honolulu, and construction of its cement distribution plants on the islands of Kauai, Maui, and Hawaii.

Clays.—Clay mining was reactivated on Oahu by the new and only manufacturer of brick, tile, flower pots, and vitrified sewer and drain pipe. The newly named Hawaii Clay Products, Inc., which was established in 1961 as Alii Enterprises, Inc., obtained raw clay near Waimanalo and Kaneohe for use in its clay-products plant at Barbers

[2] Calhoun, W. A., and T. E. Hill, Jr. Metallurgical Testing of Hawaiian Ferruginous Bauxites. BuMines Rept. of Inv. 6003, 1962, 43 pp.

[3] Patterson, S. H. Investigation of Ferruginous Bauxite and Plastic Clay Deposits on Kauai and a Reconnaissance of Ferruginous Bauxite Deposits on Maui, Hawaii. Geol. Survey, Open File Report 663, 1962, 336 pp.

Point. Raw clay output in 1962 was greater than the combined annual production rate of the two earlier clay-product manufacturers. The new company also conducted exploratory work at potential clay deposits in the Aiea and Waipio Gulch areas on Oahu, and announced plans for installing a $200,000 automated tunnel kiln, 212 feet long, to supplement its round downdraft kiln, and modern grinding, screening, pugging, and extrusion machinery.

Gem Stones.—Scuba divers continued to work deposits of black coral gem material in the deep channel waters off western Maui. This extremely hazardous exposure of the divers to the bends claimed the life of a Maui Island scuba diver in October 1961. During 1962, new locations of black coral trees were discovered in the waters off Makena, Maui Island, and off the northeastern Cape Kuikui section of Kahoolawe Island. Maui Divers of Hawaii, Ltd., at Lahaina, Maui, cut and polished the precious gem material at its lapidary, and used silver wire and mounts to fashion various jewelry items. None of Hawaii's olivine gem stone was collected in commercial quantities in 1962.

Lime.—The quantity of hydrated lime sold or used by producers on Oahu and Maui rose to 15,243 tons. The average value of the open-market and captive lime, f.o.b. plant, excluding cost of containers, advanced from $24.77 per ton in 1961 to $25.30 per ton. Substantial gains occurred in lime shipments to sugar mills for clarifying cane juice and to pineapple canneries for adjusting the acidity of pineapple juice. Increased sales of mason's lime to the consumers of neighboring islands offset declines in the masonry market on Oahu. Less lime was sold for use in food and food byproducts and for agricultural purposes, primarily for soil neutralization and conditioning.

Pumice (Volcanic Cinder).—The total output of trachyte, volcanic cinder, and volcanic ash, declined from 324,000 tons in 1961 to 232,000 tons. Seventy-seven percent of the output was used to construct and maintain secondary and tertiary roads and 23 percent was used for lightweight concrete aggregate, roofing granules, agricultural soil, and cushion under concrete slabs and drain pipes. Deposits on Hawaii Island yielded only 186,000 tons compared with 249,000 tons in 1961, and this was largely the result of the reduced use of cinder for plantation roads. Barge shipments to Oahu of trachyte from Hawaii Island and of cinder from Molokai were appreciably greater, because the demand continued for lightweight concrete aggregate and prestressed and precast concrete products, particularly for use in building high-rise structures.

Salt.—Commercial output of solar evaporated salt was limited to the yield from a 7.7-acre facility at Sand Island near Honolulu. The recovery of salt from sea water at this operation was appreciably greater than in 1961. The solar salt plant established in 1961 at Barbers Point, Oahu, was abandoned early in 1962 because the City and County of Honolulu refused to approve an application for zoning the saltpond area.

Sand and Gravel.—Increased quantities of basaltic gravel, cobbles, and boulders produced from stream and beach deposits for construction or repair of roads and embankments advanced the total sand and gravel output to 700,000 tons. The yield of coral beach and dune sands as well as basaltic beach and stream sand also increased. Sand

production from northern Oahu dropped sharply. Although substantially increased quantities of natural sand were barged from Molokai to Oahu, the total apparent consumption of coral concrete sand was proportionately lower on Oahu and higher on Kauai and Maui. Crusher run basalt and trachyte fines were used on Hawaii Island as a sand substitute, because coral sand was lacking. Much basaltic streambed gravel was produced on Maui for commercial use in ready-mixed concrete.

Stone.—Production of stone at commercial and Government-and-contractor operations declined from 4.4 million tons in 1961 to 4.1 million tons. This decrease was caused by the decline in commercial building construction; the termination of stone production at the site of an Oahu freeway project in 1961; and the substitution of basaltic beach and stream gravel for stone in the construction of roads and retaining walls. Although the quantity of basalt produced at commercial quarries on Hawaii, Kauai, Maui, Molokai, and Oahu gained nearly 100,000 tons in 1962, the total basalt output declined to 2.5 million tons. Total consumption of limestone quarried or dredged on Hawaii, Kauai, and Oahu decreased to 884,000 tons despite increased Government use of surplus dredged coral limestone for fill projects. The output at quarries, which supplied limestone aggregate for the manufacture of concrete building blocks, also decreased. Cement plants on Oahu consumed 256,000 tons of quarried limestone, in addition to 79,000 tons of basalt and trachyte (for their silica content) and imported silica sand and gypsum. Output of miscellaneous stone, including Hawaiian aa, fieldstone, and decomposed rock, was less than in 1961. Demand for moss rock and lava slabs as decorative interior and exterior building stone was much greater.

With the exception of dredged coral, all of the stone used in Hawaii was obtained by open-pit or surface strip mining methods. Basalt was drilled and blasted at single and multiple benched quarries; the relatively soft coral limestone was quarried with diesel shovels or bulldozers with ripper teeth; and miscellaneous stone was obtained with diesel shovels or front-end loaders. Moss rock, One-Man-Stone, and lava slabs were gathered by hand methods.

Vermiculite.—Vermiculite of Hawaii, Inc., operated an exfoliation furnace on Oahu to expand vermiculite for use as lightweight aggregate, acoustic, and roof insulation. The company obtained its raw material from the Zonolite Co. mine near Libby, Montana, the Nation's largest source of crude vermiculite.

MINERAL FUELS

Marking completion of phase two of its refinery building program, which included construction of a fluid catalytic cracking plant, Standard Oil Co. of California dedicated the first major oil refinery in Hawaii on January 11. Built at Barbers Point on Oahu at a total investment of $65 million, the refinery had a rated crude capacity of 35,000 barrels per day. Its products included three grades of automobile gasoline, four of aviation gasoline, two of jet fuel, two of light diesel fuel, four of asphalt, and four of heavy fuel oil, and liquefied petroleum gas and chemicals. Sulfur was removed from the refinery

gases to reduce pipeline corrosion and atmospheric pollution to make the gas more acceptable as a fuel and to provide a sulfur byproduct. The byproduct sulfur, stockpiled at the nearby acid plant, was utilized to make sulfuric acid for refinery use and for sale to local consumers.

REVIEW BY ISLANDS

Hawaii.—James W. Glover, Ltd., quarried and crushed substantially larger quantities of basalt and aa rock at its Hilo quarry, at the 299th Hawaii National Guard pit, and at a deposit near Kalopa. The material was used in the increased building and paving projects on the island, including the redevelopment of Hilo, the extension to pier 1 at Hilo Harbor, the extensions to runways at Lyman and Kona airfields, and the construction of roads near Kumukahi, Kapoho, and the South Point missile tracking station.

The 299th Hawaii National Guard pit and other aa, decomposed rock, and volcanic cinder deposits on the island were also worked by major contractors, including Kuwaye Bros., Inc., and Yamada & Sons, Inc. Under a joint-venture State highway contract, Kuwaye supplied aggregate material for improving the winding road between Honokaa and Mud Lane, located midway between Honokaa and Kamuela. Yamada quarried much of the Hilo Sugar Co., Ltd., requirements of road construction material from the 299th Hawaii National Guard pit and the Akolea quarry and also supplied road aggregate to the Hakalau Sugar Co., Ltd., and the Onomea Sugar Co. Plantation crews worked the Hilo Sugar Co. Halai Hill quarry. Hawaiian Agricultural Co., Ltd., at Pahala; Honokaa Sugar Co. at Haina; Kohala Sugar Co. at Hawi; and Pepeekeo Sugar Co., also were among the many plantation operators who utilized volcanic aggregate from company pits for continued maintenance of their sugarcane haulage roads.

TABLE 2.—Value of mineral production in Hawaii, by counties

County	1961	1962	Minerals produced in 1962 in order of value
Hawaii	$2,054,724	$1,774,610	Stone, sand and gravel, pumice (volcanic cinder).
Honolulu	[1] 12,165,816	11,771,417	Cement, stone, lime, sand and gravel, pumice (volcanic cinder), clays, salt.
Kauai	208,032	284,065	Stone, pumice (volcanic cinder), sand and gravel.
Maui	561,106	1,012,830	Sand and gravel, stone, lime, pumice (volcanic cinder), gem stones.
Total	[1] 14,990,000	14,844,000	

[1] Revised figure.

The Kapoho and Pahoa areas were sources of lava slabs about 4 inches thick, obtained by several producers for decorative building stone. A volcanic ash and cinder pit near Kapoho supplied cinder for various subdivision road jobs and ash which was screened for use at the Keaau Orchard, the largest single source of macadamia nuts in the world. A small quantity of volcanic cinder and basaltic rock was produced from deposits near Kamuela for use in rockwalls, cesspools, for cattle ranch roads, and for building purposes. State highway forces worked the Kohala Mountains pit and a pit near Keaumoku along

the Saddle Road for aggregate material used to stabilize road shoulders. County crews produced nearly 27,000 tons of cinder at various locations for road construction and maintenance.

Volcanite, Ltd., mined trachyte at the Puuwaawaa quarry about 18 miles southwest of Kamuela, near State Highway 19. Gyratory and roll crushers were utilized to process the material from the large and unique deposit of unconsolidated trachyte; which was used locally as lightweight concrete aggregate and was barged to Oahu via Kawaihae Harbor for use in lightweight building blocks and concrete high-rise structures. Much of the excess dredged coral limestone at Kawaihae Harbor was crushed and used for the soil conditioning of agricultural lands. J. M. Tanaka Contractors, Inc., quarried basalt and aa rock from deposits southeast of Kailua-Kona for use in asphaltic and portland cement concrete. Hawaii National Park crews and contractors produced road material from cinder and lava deposits in the volcano area.

Kauai.—Grove Farm Co., Ltd., Kauai's sole commercial producer of basalt rock near Puhi and of limestone near Koloa, added a new sand roll to its processing equipment to obtain a wider range of basaltic concrete aggregate required for the accelerated building activity on the island. The company made stockpile withdrawals of crushed limestone and also worked its Koloa cinder deposit for surfacing its well maintained heavy-duty haulage roads. Some of the crushed limestone was screened to ⅛-inch mesh for agricultural use.

Lihue Plantation Co., Ltd., which had made extensive use of the coral dredged from the Kapaa reef since 1959, supplemented its requirements for road construction material with volcanic rock quarried in the Kapaia Valley. Virtually all of this material was used for improvements at the company-developed fee-simple residential subdivision near Hanamaulu. The McBryde Sugar Co., Ltd., Kapeku cinder hill near Kalaheo was a source of greater quantities of aggregate material use in concrete and for road base and surfacing. An increased volume of coral sand and basaltic sand and gravel used in concrete and for patching secondary roads was obtained from accessible beach and stream deposits extending from Haena to Kealia to Bonham.

Lanai.—Dole Corporation supplied crushed rock to Government crews and contractors for construction and maintenance of public works facilities on the company-owned island. The crushed rock was from the company's stockpile of aggregates purchased from commercial producers on Oahu and transported in pineapple bins on the return trips of the barges to Lanai.

Maui.—Kahului Railroad Co. quarried increased quantities of basalt at its fixed-plant operation near Puunene and operated its portable crusher near Lahaina to process field stones for use as road fill and concrete aggregate. The company produced its own requirements of railroad ballast and supplied a substantial part of the concrete aggregate used in the construction of new buildings on Maui, including the new resort facility at Kaanapali.

Maui Concrete & Aggregates, Inc. (formerly Maui Aggregates, Inc. and Nix Readi-Mix Co., Ltd.), processed a large volume of streambed gravels near Waikapu for use at its ready-mixed concrete and concrete products plant near Naska. During the latter part of

1962, the company moved its portable crusher to Kula to supply base-course material for the $2 million Lower Kula Road project.

The Hawaiian Commercial & Sugar Co., Ltd., lime plant, which was ½ mile west of Lower Paia, utilized a 5- by 110-foot rotary kiln and a continuous hydrator to produce hydrated lime for sugar mills, pineapple canneries, agricultural liming, and masonry mortar. Coral sand from the nearby beach was used as raw material to produce the lime. Company crews operated a power shovel to obtain volcanic cinder from the Puuhele pit and processed the material for construction of a company-developed subdivision.

Maui Pineapple Co., Ltd., a newly merged corporation of the former Baldwin Packers, Ltd., and Maui Pineapple Co., Ltd., worked the Honokohau Ash Pit with a bulldozer to produce material for the construction and maintenance of company roads. County crews operated the pit during the last half of 1962. Public works crews also obtained cinder for roads from various other deposits, including the Puu Pane, Ulupalakua, and Launiupoko pits, and from stockpiles maintained at the Puunene Naval Air Base cinder area. Hawaii National Park crews at the Haleakala Crater produced a small tonnage of cinder near Red Hill for road surfacing. The Kaa beach and Wailuku dunes were sources of coral sand used in concrete and for general road repairs.

Black coral was collected in the deep waters between Maui, Lanai, and Kahoolawe Islands. Maui Divers of Hawaii, Ltd., Lahaina, used the gem material to create Hawaiian jewelry and decorative objects for the expanding market.

Molokai.—Molokai Aggregates, Inc., made improvements in its basalt crushing and conveying systems at Manawainui Gulch, near Kaunakakai, to keep pace with the increased demand on the island for concrete aggregate. Requirements of crushed basalt and stone sand for the maintenance of primary roads on Molokai were also supplied by the company. The Puuluahine and Kapaakea cinder pits, administered by the Department of Hawaiian Home Lands, were principal local sources of volcanic cinder used for construction of secondary and tertiary roads and for building projects, including the new Molokai General Hospital.

Honolulu Construction & Draying Co., Ltd. (HC&D), produced coral sand at Papohaku Beach and lightweight volcanic cinder at Waieli and shipped increased quantities of both of the materials through Lono Harbor to Oahu Island for use in concrete, as roofing granules, and for sandblasting. The contract for barging the sand and cinder 42 miles from Molokai to Oahu required a minimum guarantee of 150 trips per year at $900 per trip. An unprecedented storm in December virtually destroyed the company's sand loading tunnel at Papohaku Beach.

Oahu.—The combined value of the portland cement shipped from the Hawaiian Cement Corp. dry-process plant at Barbers Point and from the Permanente Cement Co. wet-process plant at Waianae amounted to $6 million of the total value of Honolulu County mineral output. Nearly 2.3 million tons of basalt and 849,000 tons of coral limestone were sold or used on Oahu. The output of both of these basic construction materials was less than in 1961.

Pacific Cement and Aggregates, Inc. (PCA), which operated a 3-million-barrel-capacity cement plant and 13 sand and gravel pits and stone quarries in northern California, was the principal commercial producer of stone on Oahu and in the State. PCA quarried basalt at the Halawa quarry near Aiea and limestone near Lualualei. Pacific Concrete & Rock Co., Ltd., produced limestone at the Kailua quarry and basalt rock near Ewa at the Palailai quarry where a fine reduction plant was added to the processing equipment. HC&D quarried and processed basalt at its Kapaa quarry near Kailua for concrete and road aggregate, as roofing granules, and for stone sand used at shipyards for sandblasting. HC&D also was the principal supplier of coral concrete sand and lightweight red volcanic cinder, which were barged to Oahu from the company's $1.5 million sand and cinder facility on Molokai. A mixture of two-thirds No. 2 crushed limestone from the Kailua quarry and one-third No. 2 crushed basalt from the Kapaa quarry was used by Nordic Construction Co., Ltd., for the exposed aggregate in the tilt-up walls of the first Safeway supermarket in Honolulu.

Nanakuli Paving & Rock Co., Ltd., made stockpile withdrawals of limestone at the Testa quarry near Nanakuli and operated the nearby Valley quarry crusher and batch plant using purchased basalt. Hawaiian Bitumuls & Paving Co., Ltd., formerly Hawaiian Rock & Supply Co., Ltd., worked a 30-foot face at the Kaena basalt quarry near Camp Erdman, mainly for aggregate in asphaltic concrete. Oahu Aggregates, Inc., produced limestone aggregate and stone sand at Barbers Point, mostly for sale to manufacturers of hollow block. Hawaiian Cement Corp. at Barbers Point obtained its raw material requirements of limestone from a nearby company quarry. The Maile quarry near Waianae supplied Permanente Cement Co. with raw limestone for its cement plant, where the minus ¾-by 0-inch crusher discharge was belt-conveyed to a sand processing facility.

An appreciable quantity of select basaltic borrow and untreated basaltic base material was used for a freeway project in Honolulu. The primary and secondary crushers, used by Morrison-Knudsen Co., Inc., to produce a large amount of basalt aggregate in 1961, were dismantled and shipped out of the Hawaiian Islands.

Field boulders from the Kamilonui Valley and black cinder from Makiki Round Top were processed for use in making concrete building products for the Kaiser Hawaii-Kai Marina sub-division. Substantial quantities of the cinder from Makiki Round Top also were sold for use as cushion material under drain pipes and concrete slabs, fill for horsepens, decorative fill, and soil for exotic plants.

The Kahuku Plantation Co. Malaekahana quarry near Kahuku was one of the few limestone deposits where drilling and blasting was required to break the material. Maintenance crews crushed the stone for use on the plantation haulage roads. Ewa Plantation Co. crews quarried an increased volume of coral limestone from a 15-foot pit, mainly for construction of new roads to facilitate maneuvering a portable overhead irrigation pumping unit. Joe's Moss Rock Co. worked approximately 18 acres of the Waianae area to meet increased demand for their hand-gathered decorative building stone. An Army engineer battalion at Schofield Barracks worked the multiple-benched

basalt quarry and crushing plant at the nearby Kolekole Pass. Government crews at other installations used quarried and dredged coral limestone to construct and rehabilitate roads and runways.

GasprO, Ltd., produced hydrated lime at its 50-ton-per-day plant near Waianae for use at sugar mills and pineapple canneries and for masonry mortar and agricultural liming of fields. Equipment at the plant included a 6- by 90-foot rotary kiln and a 4- by 15-foot hydrator. Limestone was supplied by a nearby commercial quarry operator. Hawaii Clay Products, Inc., obtained raw clay from State lands near Waimanalo and from the Kaneohe Ranch land near Kaneohe to manufacture clay products at Barbers Point. Tamotsu Tanaka recovered salt from sea water by solar evaporation at Sand Island near Honolulu. Smith Chemical Products, Inc., which had leased a 9.25-acre site at Barbers Point in October 1960, constructed a pilot salt plant. and made test runs in 1961, abandoned the operation in 1962. A request to zone the salt bed area was denied by the City Planning Commission. Crude vermiculite from Montana was expanded by Vermiculite of Hawaii, Inc., Honolulu, to supply island builders with special lightweight aggregates.

The Mineral Industry of Idaho

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Idaho Bureau of Mines and Geology for collecting information on all minerals except fuels.

By Frank B. Fulkerson,[1] Richard W. Knostman,[2] and Norman S. Petersen[3]

GREATER output of lead, zinc, silver, sand and gravel, and phosphate rock brought Idaho mineral production value to $82.6 million and was virtually the same as the record high of $82.8 million produced in 1951. This was a gain of $13.6 million over that of 1961. Lead output increased 12,582 tons (18 percent) despite a lower average market price. Zinc production increased 4,570 tons (8 percent). As the result of the rising market price, output of silver gained by 196,115 ounces (1 percent), and the value increased 19 percent.

TABLE 1.—Mineral production in Idaho[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Antimony ore and concentrate, short tons, antimony content	689	(2)	631	(2)
Clays, thousand short tons	[3] 27	[3] $20	35	$70
Copper (recoverable content of ores, etc.), short tons	4,328	2,597	3,861	2,378
Gold (recoverable content of ores, etc.), troy ounces	5,718	200	5,845	205
Iron ore (usable), thousand long tons	12	70	5	35
Lead (recoverable content of ores, etc.), short tons	71,476	14,724	84,058	15,467
Lime, thousand short tons	47	658	68	801
Mercury, 76-pound flasks	1,073	212		
Phosphate rock, thousand long tons	1,440	7,984	1,912	10,635
Pumice, thousand short tons	60	95	43	64
Sand and gravel, do	7,305	6,793	14,321	13,029
Silver (recoverable content of ores, etc.), thousand troy ounces	17,576	16,249	17,772	19,283
Stone, thousand short tons	1,873	3,111	1,381	2,698
Titanium concentrate, short tons, gross weight	1,873	28	(2)	(2)
Zinc (recoverable content of ores, etc.), short tons	58,295	13,408	62,865	14,459
Value of items that cannot be disclosed: Barite, cement, clays (fire clay, kaolin, bentonite, 1961), garnet (abrasive), gem stones, mica (1962), peat, perlite, tungsten (1961), uranium ore, vanadium, and values indicated by footnote 2		2,885		3,451
Total		[4] 69,034		82,575

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Excludes certain clays included with "Value of items that cannot be disclosed."
[4] Revised figure.

[1] Economist, Bureau of Mines, Albany, Oreg.
[2] Geologist, Bureau of Mines, Albany, Oreg.
[3] Mineral specialist, Bureau of Mines, Albany, Oreg.

Copper output, mainly a byproduct of silver ore, dropped 11 percent. Other byproduct metals were gold, antimony, and cadmium. The bulk of the metal-mine value came from the Bunker Hill, Page, and Star (lead-zinc ore), Sunshine and Galena (silver ore), and Lucky Friday (lead ore) mines, in the Coeur d'Alene mining region, Shoshone County. In addition to gold, silver, copper, lead, and zinc, in other areas, iron ore, uranium, and vanadium were produced. Vanadium was recovered from ferrophosphorus resulting from elemental-phosphorus production near Pocatello. No mercury was produced in the State for the first time since 1950. The Idaho-Almaden mine, near Weiser, which yielded more than 1,000 flasks in 1961, was not operated. In Boundary and Lemhi Counties, exploration and development of thorite deposits were conducted.

Sand and gravel production increased from 7.3 million tons ($6.8 million) in 1961 to 14.3 million tons ($13.0 million). Sand and gravel was the leading commodity produced in 26 of the 42 counties having mineral production. The greater quantity used at State highway department projects was the principal reason for the sharp rise in tonnage.

Production of marketable phosphate rock totaled 1.9 million long tons, compared with 1.4 million tons in 1961. Exploration of phosphate deposits north of Soda Springs, Caribou County, was in progress. Production and shipments of portland cement increased compared with totals for 1961.

The mineral production index was 116, compared with 103 in 1961 (1959=100). The index was an average of the percentage gains and losses in quantities produced, weighted by the 1962 commodity values.

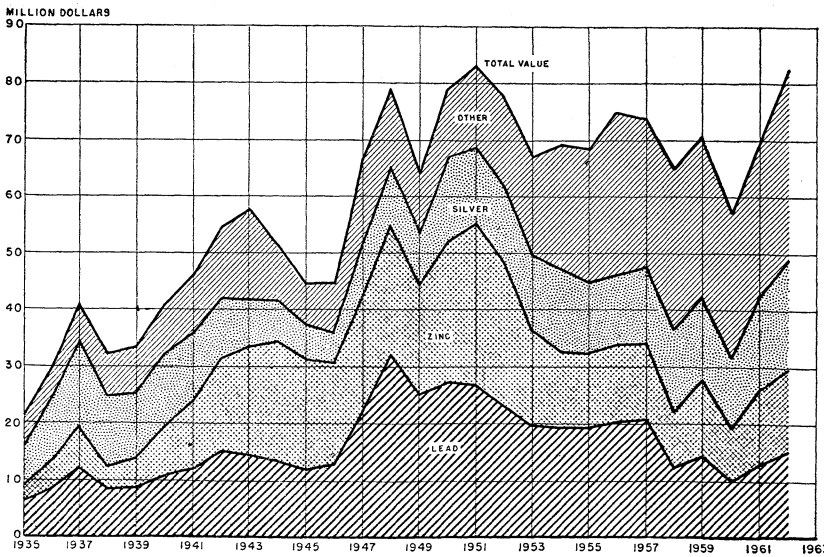

FIGURE 1.—Value of silver, lead, and zinc and total value of mineral production in Idaho, 1935–62.

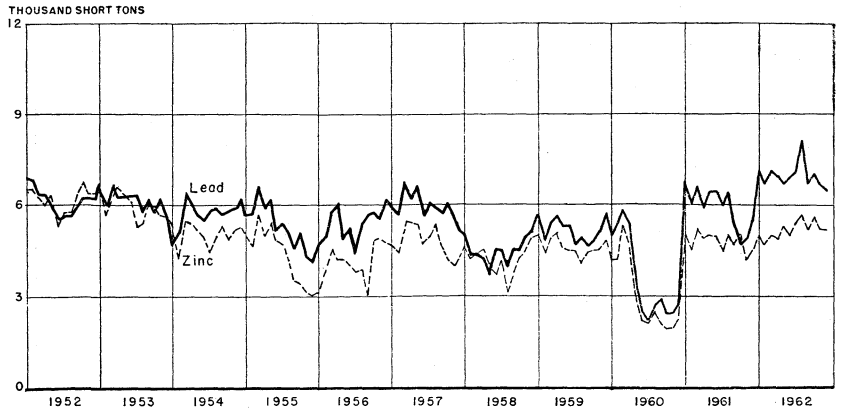

FIGURE 2.—Mine production of lead and zinc in Idaho, 1952–62, by months in terms of recoverable metals.

The following commodities, listed in decreasing order of value, supplied 88 percent of the total value of mineral production in the State: Silver, lead, zinc, sand and gravel, and phosphate rock.

Average monthly employment in the construction industry, which was a large consumer of mineral products, was 10 percent higher than in 1961. The monthly trend was downward after midyear owing to completion of work at the Mountain Home Titan missile base. Construction activity was strong in nearly all areas of the State. Value of contract work completed on highways gained 29 percent over that of 1961. Building permits in the principal cities and towns increased 3 percent in value. Total personal income and personal income per

TABLE 2.—Indicators of Idaho business activity

		1961	1962 [1]	Change, percent
Personal income:				
Total	millions	$1,236.0	$1,342.0	+8.6
Per capita		$1,807.0	$1,923.0	+6.4
Construction activity:				
Building permits	millions	$36.6	$37.8	+3.3
Heavy engineering awards	do	$86.7	$60.7	−30.0
State highway commission:				
Value of contracts awarded	do	$34.0	$26.6	−21.8
Value of contract work performed	do	$23.2	$29.9	+28.9
Cement shipments to and within Idaho thousand 376-pound barrels		1,125.4	1,090.8	−3.1
Cash receipts from farm marketings	millions	$427.8	$450.2	+5.3
Mineral production	do	$69.0	$82.6	+19.7
Factory payrolls	do	$153.2	$161.4	+5.4
Annual average labor force and employment:				
Total labor force	thousands	266.6	266.6	.0
Unemployment	do	17.1	14.8	−13.5
Employment:				
Construction	do	10.3	11.3	+9.7
Food processing	do	11.3	11.1	−1.8
Lumber	do	10.9	10.9	.0
All manufacturing	do	31.4	31.6	+.6
All industries	do	249.4	251.6	+.9

[1] Preliminary figures.

Sources: Survey of Current Business, Construction Review, Pacific Builder and Engineer, Idaho State Highway Commission, The Farm Income Situation, Idaho Labor Market, Labor Force and Employment in Idaho, Distribution by Industry of Wages Paid for Covered Employment in Idaho, and Bureau of Mines.

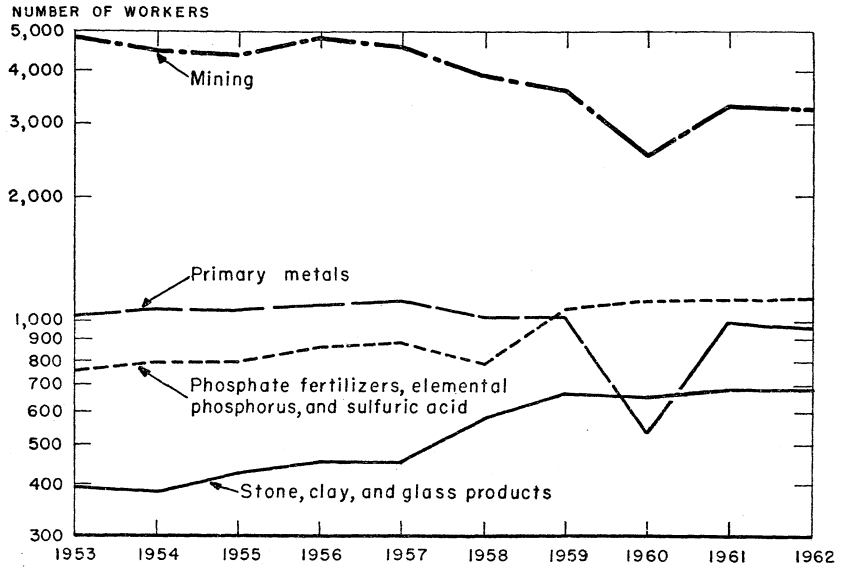

FIGURE 3.—Employment Trends, 1953–62.
(Source: Idaho Employment Security Agency.)

capita gained by 9 percent and 6 percent, respectively, principally because of a rise in farm income. Average monthly unemployment declined 14 percent because of gains in several nonagricultural industries, principally construction, retail and wholesale trade, and service and miscellaneous industries that more than offset a decrease in average monthly employment in agriculture.

An Idaho Bureau of Mines and Geology publication reviewed conditions in the mining industry of the State in 1961.[4]

The State Department of Commerce and Development published a book discussing the land, natural resources, people, government, industry, and commerce of Idaho.[5]

Employment and Injuries.—Employment figures, provided by the Idaho Employment Security Agency, showed that average monthly employment in metal mining and primary metals processing (mostly smelting and refining) declined slightly. The average number of workers in phosphate fertilizer, elemental phosphorus, and sulfuric acid production was the same as in 1961.

Government Programs.—Under the program of the Office of Minerals Exploration (OME), U.S. Department of the Interior, contracts were active in Kootenai (Commonwealth Silver, Inc., lead-zinc-silver), Lemhi (Idaho Copper Mines, Inc., copper-cobalt), and Valley (T. R. Baugh, mercury) Counties.

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[4] Cook, E. F. A Silver Lining in Idaho Mining. Idaho Bureau of Mines and Geol. Inf. Circ. 12, 1962, 19 pp.
[5] Idaho Department of Commerce and Development. The Idaho Almanac, Territorial Centennial Edition 1863–1963. 1962, 669 pp.

TABLE 3.—Annual employment and wages paid in the mineral industries

Year	Mining							
	Metals		Nonmetals		Fuels		Total	
	Annual average employment	Annual payroll (thousands)	Annual average employment	Annual payroll (thousands)	Annual average employment	Annual payroll (thousands)	Annual average employment	Annual payroll (thousands)
1958	3,633	$19,359	259	$1,281	27	$149	3,918	$20,789
1959	3,305	18,393	292	1,379	20	127	3,619	19,899
1960	2,282	13,550	235	1,187	20	132	2,537	14,869
1961	3,032	17,607	288	1,785	2	5	3,322	19,397
1962 [1]	2,996	17,336	270	1,546	----------	----------	3,266	18,882
	Manufacturing							
	Stone and clay products		Primary metals		Phosphate fertilizers, elemental phosphorus, and sulfuric acid		Total	
	Annual average employment	Annual payroll (thousands)	Annual average employment	Annual payroll (thousands)	Annual average employment	Annual payroll (thousands)	Annual average employment	Annual payroll (thousands)
1958	579	$2,760	1,034	$5,314	787	$4,518	2,400	$12,592
1959	664	3,228	1,036	5,656	[2] 1,139	[2] 6,834	2,839	15,718
1960	654	3,376	534	3,023	1,244	7,991	2,432	14,390
1961	677	3,457	1,008	5,750	1,250	8,263	2,935	17,470
1962 [1]	686	3,936	970	5,497	1,254	8,240	2,910	17,673

[1] Preliminary figures.
[2] Part of the 1959 gain was due to obtaining greater detail from multi-industry employees.

Source: Idaho Employment Security Agency; employment covered by unemployment insurance. Industry groups may not correspond with those in the Bureau of Mines canvass.

TABLE 4.—Hours and earnings of production workers in mining

	1958	1959	1960	1961	1962
Annual average:					
Weekly earnings	$95.68	$101.91	$103.21	$105.32	$107.32
Hourly earnings	$2.53	$2.58	$2.66	$2.62	$2.72
Weekly hours	37.7	39.5	38.8	40.2	39.4

Source: Idaho Employment Security Agency.

TABLE 5.—Injuries in the mineral industries [1]

Year and industry	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:						
Quarries and mills [2 3]	189	125	189,620	----------	2	11
Nonmetal mines and mills	660	262	1,387,591	1	18	14
Sand and gravel operations [3]	238	141	269,332	----------	3	11
Metal mines and mills	2,664	238	5,069,890	----------	523	103
Coal mines	----------	----------	----------	----------	----------	----------
Total	3,751	230	6,916,433	1	546	79
1962: [4]						
Quarries and mills [2 3]	271	129	279,637	----------	1	4
Nonmetal mines and mills	648	250	1,298,429	1	23	18
Sand and gravel operations [3]	323	129	332,457	1	1	6
Metal mines and mills	2,603	237	4,930,360	3	421	86
Coal mines	----------	----------	----------	----------	----------	----------
Total	3,845	222	6,840,883	5	446	66

[1] Compiled by the Bureau of Mines from reports by individual companies.
[2] Includes cement- and lime-processing plants.
[3] Includes only commercial operations.
[4] Preliminary figures.

TABLE 6.—Office of Minerals Exploration contracts active during 1962

County and contractor	Commodity	Contract		
		Date	Total amount	Government participation, percent
Kootenai:				
Commonwealth Silver, Inc.	Lead-zinc-silver	Dec. 18, 1961	$46,640	50
Lemhi:				
Idaho Copper Mines, Inc.	Copper-cobalt	Sept. 21, 1961	88,030	50
Valley:				
T. R. Baugh	Mercury	Dec. 22, 1961	18,510	50

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—Largely a byproduct of silver production, antimony output declined 8 percent below that of 1961. Approximately 567 tons of cathode metal, containing 95.1 percent antimony, was recovered at the Sunshine Mining Co. electrolytic plant from ore mined at the Sunshine (84 percent) and Silver Summit (16 percent) mines, Shoshone County. Shipments of cathode metal were 674 tons—1,051 tons less than those in 1961. Sunshine mine production declined as a result of a strike by United Steelworkers of America that shut down the operation from October 1 to November 5.

Antimony Gold Ores Co., Boise, shipped 91 tons of antimony, as concentrate containing 62 to 64 percent antimony, to W. R. Grace & Co. The ore was strip mined at various properties in Valley County and concentrated in a 50-ton-per-day flotation mill at Yellow Pine.

Antimony was recovered as antimonial lead from domestic and foreign concentrates shipped to The Bunker Hill Co. lead smelter at

Kellogg. This production was not identifiable as to source and was not included in the State mineral-production totals.

Cadmium.—A record quantity (826,884 pounds) of electrolytic cadmium was recovered from domestic and foreign concentrates processed at The Bunker Hill Co. electrolytic zinc plant near Kellogg. Sales of the metal also were at a record level, reflecting an increased market demand nationally. Cadmium output was not included in State mineral production totals because its source was not identifiable.

Columbium-Tantalum.—The Porter Bros. Corp. mill at Lowman and dredges at Bear Valley, although idle since October 1959, were maintained in operating condition. The possibility of resumed operation was dependent upon obtaining suitable markets for mill products, which would consist of euxenite, columbite, monazite, ilmenite, magnetite, zircon, and garnet.

Copper.—The lowest since 1953, copper output declined 11 percent from the 4,328 tons produced in 1961. Approximately 71 percent was recovered as a byproduct of silver ore. Of the nine counties recording copper production three counties produced 98 percent of the total—Shoshone (89 percent), Custer (6 percent), and Adams (3 percent). Much of the output came from the Galena mine, operated by American Smelting and Refining Co., and the Sunshine mine of Sunshine Mining Co.

Gold.—Production of gold increased slightly (2 percent) over the record low of 1961. Gold recovered as a byproduct of base-metal and silver ores accounted for 75 percent of the output. Placer mines

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1953–57 (average)	104	26	2,037	12,592	$441	14,576	$13,192
1958	85	31	1,681	15,896	556	15,953	14,438
1959	47	24	1,834	10,479	367	16,636	15,057
1960	79	20	1,105	6,135	215	13,647	12,351
1961	60	22	1,497	5,718	200	17,576	16,249
1962	60	13	1,586	5,845	205	17,772	19,283
1863–1962 [3]	----------	----------	142,903	8,306,758	193,876	752,563	572,613

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	5,630	$3,852	68,807	$19,668	58,877	$13,999	$51,152
1958	9,846	5,179	53,603	12,543	49,725	10,144	42,860
1959	8,713	5,350	62,395	14,351	55,699	12,811	47,935
1960	4,208	2,702	42,907	10,040	36,801	9,495	34,802
1961	4,328	2,597	71,476	14,724	58,295	13,408	47,178
1962	3,861	2,378	84,058	15,467	62,865	14,459	51,792
1863–1962 [3]	179,075	75,860	7,096,100	978,125	2,337,663	481,647	2,302,122

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings, and old slag re-treated, and ore shipped to smelters during the calendar year indicated. Because of rounding, individual items may not add to total shown.
[2] Does not include gravel washed.
[3] Partly estimated for years before 1901.

TABLE 8.—Gold production at placer mines

Year	Mechanical and hydraulic methods [1]			Small-scale hand methods			Total		
	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)
1953–57 (average)	17	763	4,339	10	3	64	26	766	4,403
1958	13	92	2,501	18	7	89	31	100	2,590
1959	10	92	1,878	14	5	89	24	98	1,967
1960	9	64	793	11	6	50	20	70	843
1961	8	60	488	14	9	53	22	69	541
1962	[2] 7	38	318	6	8	58	13	46	376

[1] Combined to avoid disclosing individual company confidential data.
[2] Includes 3 hydraulic operations, 2 dragline dredges, 1 bucketline dredge and 1 nonfloat washing plant.

yielded 376 ounces, the lowest quantity since 1944 and the third lowest output on record.

The Lucky Friday mine, Shoshone County, supplied the largest quantity of gold. The Gem State Consolidated Mines, Inc., Dewey group, Gem County, was the second largest producer followed by output from the Bunker Hill mine.

Shoshone County operations supplied 68 percent of the State total, followed by Gem (14 percent) and Custer (5 percent); 11 other counties accounted for the remainder.

Feather Placers (Feather Placer claim groups), Bonneville County, and Idaho Mining & Milling Co. (Florence Basin placers), Idaho County, produced 67 percent of the gold recovered at 14 placer operations in 10 counties.

Iron Ore.—Output of iron ore declined more than 60 percent from the 12,071 long tons produced in 1961. Ore was extracted from three mines—Cudahy Mountain (George Budock) and Campbell (Joe Holcomb), Washington County, and McCleary Butte (C. C. Hill), Benewah County—and shipped to steel producers and cement plants. Porter Bros. Corp. shipped magnetite sand from a stockpile in Boise County; the material was dredged previously at a placer operation in Valley County.

Lead.—Output of lead, the largest since 1950, increased 12,582 tons (18 percent) over that of 1961 despite the lowest average market price ($0.092 per pound) since 1946. Shoshone County with production from the Bunker Hill and Lucky Friday mines and the Star Unit area accounted for over 99 percent of the State total. The largest producer outside of Shoshone County was Clayton Silver Mines (Clayton mine), Custer County, which accounted for 575 tons.

Day Mines, Inc., closed the Dayrock mine, Placer Center district, Shoshone County, in August. The mine had been operated continuously since its discovery in 1923, except for several years in the 1930's.

Subsidy payments were received by six lead-zinc mine operators for production under the Government lead and zinc mining stabilization program (Public Law 87–347). Payments of $104,140 were made on 1,358 tons of lead ($100,132) and 126 tons of zinc ($4,008). Eleven producers were certified as eligible to receive payments on 6,776 tons of lead and 3,821 tons of zinc, but the output by these operators was far short of the eligible quantity.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1962, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
Adams	2		27	$1	3,294	$4
Blaine	5		22	1	14,933	16
Boise	5	1	132	5	757	1
Bonneville		1	131	5	3	(1)
Custer	6	2	318	11	134,197	146
Gem	1		828	29	1,730	2
Idaho	4	3	218	8	126	(1)
Lemhi	9	1	53	2	1,809	2
Owyhee		1	5	(1)		
Shoshone	17	1	3,959	139	17,578,155	19,072
Valley		1	9	(1)	9	(1)
Unassigned	7		11	(1)	620	1
Undistributed [2]	4	2	132	5	36,802	40
Total [3]	60	13	5,845	205	17,772,435	19,283

County	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
Adams	107	$66					$70
Blaine	1	1	86	$16	25	$6	39
Boise	(4)	(1)	(4)	(1)			5
Bonneville							5
Custer	(5)	(5)	588	108	(5)	(5)	433
Gem	(4)	(1)	3	(1)	2	1	32
Idaho			(5)	(5)	(5)	(5)	8
Lemhi	(5)	(5)	(5)	(5)	(5)	(5)	60
Owyhee							(1)
Shoshone	3,435	2,116	83,339	15,334	62,713	14,424	51,085
Valley							(1)
Unassigned	4	3	2	(1)	(4)	(1)	4
Undistributed [2]	(4)	(1)	24	4	2	(1)	49
Total [3]	3,861	2,378	84,058	15,467	62,865	14,459	51,792

[1] Less than $500.
[2] Includes values and quantities that cannot be shown separately for Bonner, Boundary, Jerome, and Twin Falls Counties.
[3] Individual items may not add to total shown.
[4] Less than 0.5 ton.
[5] Figure withheld to avoid disclosing individual company confidential data.

Production from The Bunker Hill Co. lead smelter was 93,647 tons, a 14,310-ton drop from that of 1961. The decline resulted from a shortage of lead concentrate.

Mercury.—For the first time since 1950, mercury was not produced in the State. The Idaho-Almaden mine, which yielded 1,073 flasks in 1961, was not operated; however, exploratory drilling was conducted on the property by the mining division of El Paso Natural Gas Co. Rare Metals Corporation of America, previous operator of the property and formerly a subsidiary of El Paso, was dissolved when El Paso purchased the outstanding shares of Rare Metals stock.

Silver.—Production of silver increased 196,115 ounces (1 percent) over that of 1961; only in 1937 and 1938 was more silver produced. The value of production increased nearly 19 percent because of the rising market price of silver, which began in December 1961 when the Government discontinued sales of Federal silver reserves.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	9	1,081	955	1,880	400	5,800	5,000
Dry gold-silver	5	146	36	1,073	500	200	
Dry silver	10	352,635	1,111	10,895,833	5,493,000	5,307,600	625,800
Total	24	353,862	2,102	10,898,786	5,493,900	5,313,600	630,800
Copper	9	17,224	285	11,622	812,200	900	
Lead	10	213,739	1,907	3,744,707	692,500	46,165,400	4,026,700
Lead-zinc	7	882,250	1,118	3,065,705	631,100	112,636,200	108,326,500
Zinc	4	77,531	11	28,673	21,300	1,424,300	3,830,900
Total	30	1,190,744	3,321	6,850,707	2,157,100	160,226,800	116,184,100
Other lode material:							
Gold mill cleanings, lead cleanings and lead-zinc mill cleanings [2]	5	457	27	6,143		304,100	78,000
Zinc slag smelted	1	41,121		16,693	71,000	2,271,500	8,837,100
Gold old tailings	1	35	19	9			
Total lode material	60	1,586,219	5,469	17,772,338	7,722,000	168,116,000	125,730,000
Placer	13	(3)	376	97			
Total all sources	73	1,586,219	5,845	17,772,435	7,722,000	168,116,000	125,730,000

[1] Because some mines produce more than one class of material, detail will not necessarily add to total shown.
[2] Combined to avoid disclosing individual company confidential data.
[3] 45,921 cubic yards.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1962, by types of material processed and methods of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation	431	259			
Concentration and smelting of concentrates	4,774	17,698,713	7,362,300	164,969,600	116,739,600
Total	5,205	17,698,972	7,362,300	164,969,600	116,739,600
Direct smelting:					
Ore, gold mill cleanings, lead cleanings, and lead-zinc mill cleanings [1]	254	56,664	288,700	874,900	153,300
Gold old tailings	19	9			
Old slag		16,693	71,000	2,271,500	8,837,100
Total	264	73,366	359,700	3,146,400	8,990,400
Placer	376	97			
Grand total	5,845	17,772,435	7,722,000	168,116,000	125,730,000

[1] Combined to avoid disclosing individual company confidential data.

Eleven counties recorded silver production, but approximately 99 percent of the output came from mines in Shoshone County. The largest amount was extracted at the Sunshine mine (4,655,278 ounces) despite a strike by Local 5089 of United Steelworkers of America that idled the operation for 5 weeks. Other major producers included the Galena, Lucky Friday, Bunker Hill, Crescent, Silver Summit, and Star mines.

Exploration and development were conducted at the Sunshine, Galena, Lucky Friday, and other Coeur d'Alene area mines. Projects also were carried out at the Silver Star-Queens, Inc., properties, Blaine County; Conjecture mine, Bonner County; Commonwealth mine, Kootenai County; and Clayton Silver mine, Custer County.

Titanium.—Ilmenite concentrate was not produced. Porter Bros. Corp. shipped concentrate from a stockpile at Lowman, Boise County, and the J. R. Simplot Co. stockpile was exhausted by a 40-ton shipment containing 45 percent titanium dioxide (TiO_2). The ilmenite was used in high-density concrete and as roofing granules.

Thorium.—Although no thorium ore was mined, exploration and development of thorite deposits were carried out in Boundary and Lemhi Counties. The U.S. Atomic Energy Commission (AEC) announced in its annual report to Congress that domestic thorium deposits in the Lemhi Pass area of Idaho and Montana contained 100,000 tons of thorium oxide (ThO_2), and that the possibility existed for the eventual development of much larger reserves.

Information on the recovery of thorium from ores in Idaho, Montana, and Colorado was published.[6]

Tungsten.—No shipments of tungsten were recorded. Ten tons of medium grade concentrate was stockpiled by the Salmon River Scheelite Corp. The raw material was derived from a development raise in the northwest part of the company's Tungsten Jim mine near Clayton, Custer County.

Uranium.—Compared with that of 1961, quantity and value of uranium production declined 75 and 72 percent, respectively. This was the lowest output since 1957. Enderlin Mining Co. (Elk No. 1 and Deer Strike) and The Childs Co. (Lightning group), the only producers, operated mines in Custer County.

A study of uranium mines in the Stanley area, Custer County, was included in a publication by the Idaho Bureau of Mines and Geology.[7]

Vanadium.—Quantity and value of vanadium output climbed 48 percent over that of 1961. The vanadium was contained in ferrophosphorus resulting from the electric-furnace production of elemental phosphorus at the Power County plant of FMC Corp., Mineral Products Division. The ferrophosphorus, processed at Garfield, Utah, by Susquehanna Minerals, yielded vanadium pentoxide (V_2O_5) having a purity of 99.5 percent. The Garfield plant was closed in May and was inactive during the remainder of 1962. The plant had been in operation since November 1961.

Zinc.—Quantity and value of production increased approximately 8 percent over that of 1961 and was the highest since 1953. All except 152 tons of the 62,865-ton output came from mines in Shoshone County. The Star Unit area, operated by Hecla Mining Co., yielded the largest output of zinc. Other principal sources were the Bunker Hill and Page mines.

The Morning mine (American Smelting and Refining Co.) was operated through the Star mine as a part of the Star Unit area. According to the Hecla Mining Co. annual report, 218,674 tons of ore

[6] Borrowman, S. R., and J. B. Rosenbaum. Recovery of Thorium From Ores in Colorado, Idaho, and Montana. BuMines Rept. of Inv. 5916, 1962, 33 pp.

[7] Choate, Raoul. Geology and Ore Deposits of the Stanley Area. Idaho Bureau of Mines and Geol. Pamphlet 126, July 1962, 122 pp.

from the Star mine and 20,675 tons from the Morning mine averaged 5.06 percent lead, 11.04 percent zinc, and 1.66 ounces of silver per ton.

The Bunker Hill Co. electrolytic zinc plant at Kellogg established a new plant record by producing 76,755 tons of Special High Grade zinc from domestic and foreign concentrates.

NONMETALS

Barite.—There was no mine production of barite. Crude barite stockpiled at the Sun Valley mine of J. R. Simplot Co., Blaine County, was shipped to the company plant at Pocatello for grinding before marketing as a weighting agent for oil-well drilling muds. Shipments of the ground product were reduced sharply compared with those of 1961.

Cement.—Portland and masonry cements were produced at the Inkom plant of Idaho Portland Cement Co., Bannock County. Production and shipments of portland cement increased compared with totals for 1961, but masonry cement output declined. Shipments were mainly to intrastate destinations, and smaller quantities went to other markets in the Rocky Mountain area.

Clays.—The quantity of clays sold or used by Idaho producers remained substantially the same as in 1961. A sharp drop in the production of miscellaneous clay for making heavy clay products, mainly building brick, was offset by sharply increased output of paper (kaolin) and fire clays. Miscellaneous clay was produced from pits in Ada and Bonneville Counties and paper and fire clays were mined in Latah County.

Production and shipments of clay increased from the J. R. Simplot Co., Miclasil Operations, near Bovill, Latah County. Output was marketed mainly as paper-filler clay; a small quantity was sold for refractories manufacture. At the Miclasil plant, a mixture of clay, sand, and mica was separated and beneficiated to produce raw materials for the paper, refractories, and glass industries in the Pacific Northwest. Although not recovered, mica was a potential byproduct.

Garnet (Abrasive).—Shipments of garnet for abrasive use by Idaho producers increased 17 percent, compared with those of 1961; the quantity mined declined slightly. Production was from two dragline operations in Benewah County. Porter Bros. Corp., Boise County, and J. R. Simplot Co., Ada County, marketed garnet from stocks accumulated as a byproduct from milling black-sand concentrates that were dredged in Valley County.

Gypsum.—No mine production of crude gypsum was reported. Shipments for agricultural purposes continued to be made by Rock Island Gypsum Co. from stocks at the company Rock Creek mine near Weiser, Washington County. Shipments remained substantially the same is in 1961.

Lime.—Production of lime at sugar refineries totaled 67,560 tons, compared with 46,760 tons in 1961. A quantity of lime was regenerated from calcium carbonate sludge at a Kraft-paper plant in Nez Perce County. All production was for interplant use by the processing companies.

Peat.—Production of peat dropped 33 percent below that of 1961. Output, as in 1961, was from one operation near Downey, Bannock County, and was used primarily as a soil conditioner.

Perlite.—Oneida Perlite Corp. continued mining perlite at deposits 25 miles north of Malad, Oneida County. Mine production was 22 percent more than that of 1961. The ore was crushed, dried, and screened at a plant near the mine. The dried and sized product was trucked to the company storage and expanding facilities at Malad. Bulk shipments of dried and sized perlite were made to commercial expanding plants in the Western States and Canada. A portion of the output was processed at the company Malad plant. The expanded product was used mainly as plaster aggregate and as loose-fill insulation. Quantities also were marketed for concrete aggregate and soil-conditioning uses.

Phosphate Rock.—Output of marketable phosphate rock totaled 1.9 million long tons, compared with 1.4 million tons in 1961. Crude phosphate rock mined was 2.2 million long tons, an increase of 34 percent over the 1961 tonnage. Four operations—two in Caribou and one each in Bingham and Bear Lake Counties—accounted for the production. San Francisco Chemical Co. made shipments from mine stocks at its Diamond Gulch property in Caribou County to fertilizer manufacturers in the Western States. Production from all mines increased compared with that of 1961.

Phosphate rock sold or used by producers totaled 1.74 million long tons, compared with 1.69 million tons in 1961. Elemental phosphorus manufacture continued to be the leading use of phosphate rock mined in the State. The quantity of rock used for this purpose increased moderately compared with that of 1961. Other uses were in manufacturing wet-process phosphoric acid and phosphate fertilizers. Phosphate rock was reduced to elemental phosphorus at plants of Monsanto Chemical Co., Soda Springs; FMC Corp., Mineral Products Division, Pocatello; and Central Farmers Fertilizer Co., Georgetown. The elemental phosphorus produced at the Central Farmers electric-furnace plant was used in manufacturing concentrated superphosphate fertilizers at the company Georgetown works.

J. R. Simplot Co manufactured ammonium-phosphate and triple superphosphate fertilizers and wet-process phosphoric acid at its fertilizer complex west of Pocatello in Power County. In December, the company Gay mine near Fort Hall, Bingham County, was closed by a labor dispute involving the Operating Engineers Union and the Simplot company. The mine, which supplied phosphate rock to the Simplot fertilizer plant and the FMC Corp. elemental-phosphorus plant, remained closed at yearend. Approximately 50 men employed at the mine were idled by the strike.

The Bunker Hill Co., Kellogg, Shoshone County, continued production of fertilizer-grade phosphoric acid from sulfuric acid obtained from a nearby company-owned acid plant and from phosphate rock purchased from producers in Wyoming. The Bunker Hill firm investigated phosphate deposits near Garrison, Mont., as a possible source of raw material for the plant.

Exploration crews of International Minerals & Chemical Corp. were extensively investigating phosphate properties leased by Husky Oil Co. north of Soda Springs, Caribou County. International Minerals and Husky Oil in 1961 announced plans for joint exploration and development of the leased area.

Pumice and Volcanic Cinder.—Output of pumiceous materials declined 28 percent, compared with production of 1961. Pumice was

produced in Bonneville, Oneida, and Twin Falls Counties, and a quantity of volcanic cinder was mined at an operation in Canyon County. Pumice and cinder output was used chiefly as a lightweight-concrete aggregate. A small quantity of crude pumice was used for surfacing roads and as feedlot-fill material.

Sand and Gravel.—Output of sand and gravel for all purposes was 14.3 million tons, compared with 7.3 million tons in 1961. This was a record high for the State. The quantity used at State highway department projects (8.7 million tons, compared with 3.5 million tons in 1961) was the principal reason for the sharp rise in output. Increased requirements for sand and gravel also were reported by the Bureau of Public Roads and the U.S. Forest Service. Production by commercial firms was 2.7 million tons, compared with 2.2 million tons in 1961. Government-and-contractor output (largely by contractors for Federal, State, county, and municipal agencies) totaled 11.6 million tons, compared with 5.1 million tons in 1961. Production was from operations in 38 of the 44 counties in the State. Bonneville County was the leading producing county, and Bingham and Ada Counties ranked second and third, respectively.

Del Monte Properties Co. produced high-quality sand for plaster, glass, and abrasives at an operation near Emmett, Gem County. Shipments were increased over those of 1961. J. R. Simplot Co. shipped a small quantity of sand for foundry uses. Production of silica sand, a byproduct from the company Miclasil plant near Bovill, Latah County, was curtailed sharply from the total of 1961.

TABLE 12.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Building	821	$1,130	772	$1,180
Road material	1,187	1,129	1,757	1,440
Fill	81	44	70	45
Other [1]	108	114	88	92
Total	2,198	2,417	2,686	2,756
Government-and-contractor operations:				
Building			25	24
Road material	4,911	4,300	11,340	10,138
Fill	196	75	269	111
Total	5,107	4,376	11,634	10,273
All operations:				
Building	822	1,130	797	1,203
Road material	6,099	5,429	13,097	11,578
Fill	276	119	339	155
Other [1]	108	114	88	92
Grand total [2]	7,305	6,793	14,321	13,029

[1] Includes special sands, railroad ballast, and sand and gravel used for miscellaneous purposes.
[2] Owing to rounding, individual items may not add to totals shown.

Stone.—Production of stone for all purposes totaled 1.4 million tons, a decline of 26 percent from 1.9 million tons in 1961. Curtailed use at Federal projects (Bureau of Public Roads and U.S. Forest Service) in the State accounted for the drop. The use of crushed stone in State highway department road projects remained substantially the same

as in 1961. Commercial firms produced 797,000 tons, and Government-and-contractor output (largely by contractors for Federal, State, county, and municipal agencies) was 584,000 tons, compared with 500,000 and 1.4 million tons, respectively, in 1961. Basalt, the principal stone quarried, was used chiefly for road construction and maintenance purposes, and smaller tonnages were utilized as riprap. The quantity of limestone quarried increased sharply because an operation that was idle in 1961 resumed production. Cement manufacture continued to be the largest use of limestone quarried; smaller quantities were consumed by sugar refineries, metallurgical smelters, and paper plants. Quartzite for use as a flux in electric-furnace elemental-phosphorus plants was quarried in Caribou County. Stone output was reported from 17 of the 44 counties.

REVIEW BY COUNTIES

Mineral production was reported from 42 of the 44 counties. Shoshone County accounted for 62 percent of the total mineral-output value. Sand and gravel and stone were the principal or only products from 30 counties. Selected counties with significant metal and nonmetal developments are discussed in the following review.

Adams.—Copper ore was mined at two open-pit operations in the Seven Devils mining district. Approximately 106 tons of copper and 3,267 ounces of silver were produced by Otto Russell from the Old Peacock mine. The ore (890 tons) was trucked to Council and shipped by rail to the Tacoma (Wash.) smelter. Four tons of ore yielding 1 ton of copper and 27 ounces of silver was taken from the Alaska mine.

Bannock.—Portland and masonry cements were produced at the Inkom plant of Idaho Portland Cement Co. Limestone was obtained from the company-operated quarry. Quantities of purchased silica, gypsum, and iron ore also were utilized. Idaho Peat, Inc., shipped a small tonnage of reed-sedge peat from an operation near Downey. Output of sand and gravel and stone remained substantially the same as in 1961.

Bear Lake.—Mining of phosphate rock continued at the Georgetown Canyon mine of Central Farmers Fertilizer Co. Mine production advanced moderately compared with the output of 1961. A portion of the production was reduced to elemental phosphorus in a 35,000-kilovolt-ampere electric furnace at its nearby fertilizer works. The elemental phosphorus was processed to phosphoric acid, which, in turn, was reacted with phosphate rock to manufacture high-analysis phosphate fertilizer.

Benewah.—C. C. Hill mined 1,398 long tons of iron ore (hematite), a 3,781-ton decline below that of 1961, from the McCleary Butte deposit near Tensed. The production drop was the result of market curtailments. The Idaho Bureau of Mines and Geology announced that a sampling program at the McCleary Butte property indicated an ore reserve of more than 265,000 tons.

Garnet for abrasive uses was produced and shipped by Idaho Garnet Abrasive Co. and Emerald Creek Garnet Milling Co. from operations near Fernwood. In May, fire destroyed the screening units, conveyors, and bagging equipment at the mill of Emerald Creek Garnet Milling Co.

TABLE 13.—Value of mineral production in Idaho, by counties[1]

(Thousand dollars)

County	1961	1962	Minerals produced in 1962 in order of value
Ada	$500	$762	Sand and gravel, clays, ilmenite.
Adams	(2)	86	Copper, sand and gravel, silver, gold.
Bannock	(2)	(2)	Cement, sand and gravel, stone, peat.
Bear Lake	(2)	(2)	Phosphate rock, sand and gravel.
Benewah	168	165	Abrasive garnet, sand and gravel, iron ore.
Bingham	(2)	(2)	Phosphate rock, sand and gravel, vanadium, stone.
Blaine	36	208	Sand and gravel, silver, lead, barite, zinc, gold, copper.
Boise	(2)	6	Gold, silver, sand and gravel, copper, lead.
Bonner	151	400	Sand and gravel, silver, gold, lead, zinc, copper.
Bonneville	[3] 583	3,054	Sand and gravel, lime, pumice, clays, gold, stone, silver.
Boundary	79	264	Sand and gravel, stone, lead, silver, zinc, copper.
Butte	225	68	Sand and gravel.
Camas	39	----	
Canyon	465	704	Sand and gravel, lime, pumice.
Caribou	(2)	(2)	Phosphate rock, stone, sand and gravel.
Cassia	711	133	Sand and gravel.
Clark	77	5	Do.
Clearwater	179	330	Stone.
Custer	650	459	Silver, copper, lead, zinc, sand and gravel, gold, uranium.
Elmore	91	119	Sand and gravel.
Franklin	240	94	Sand and gravel, lime.
Fremont	80	621	Sand and gravel.
Gem	194	221	Sand and gravel, gold, silver, zinc, lead, copper.
Gooding	74	43	Sand and gravel.
Idaho	1,164	571	Sand and gravel, stone, gold, silver, zinc, lead.
Jefferson	28	660	Sand and gravel, stone.
Jerome	19	51	Sand and gravel, gold.
Kootenai	215	753	Sand and gravel, stone.
Latah	611	364	Stone, sand and gravel, clays, mica.
Lemhi	160	376	Sand and gravel, copper, lead, silver, gold, zinc, stone.
Lewis	64	(2)	Stone.
Lincoln	----	33	Sand and gravel.
Madison	392	406	Sand and gravel, stone.
Minidoka	441	374	Lime, sand and gravel, stone.
Nez Perce	66	410	Stone, sand and gravel.
Oneida	(3, 2)	258	Sand and gravel, pumice, perlite, stone.
Owyhee	79	124	Sand and gravel, clays, gold.
Payette	----	17	Sand and gravel.
Power	[3] 196	278	Do.
Shoshone	46,691	51,386	Silver, lead, zinc, copper, antimony, gold, sand and gravel, stone.
Twin Falls	318	731	Sand and gravel, lime, pumice, gold.
Valley	(2)	81	Antimony, ilmenite, abrasive garnet, iron ore, gold, silver.
Washington	(2)	(2)	Iron ore.
Undistributed[4]	[3] 14,048	17,960	
Total	[3] 69,034	82,575	

[1] No production reported in Teton County.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.
[4] Includes value of mineral production that cannot be assigned to specific counties and values indicated by footnote 2.

Bingham.—In terms of tonnage, the county continued to be the principal phosphate-producing area. J. R. Simplot Co. increased production of both phosphate rock and phosphatic shale at the Gay mine near Fort Hall. The phosphatic shale was reduced to elemental phosphorus at the electric-furnace plant of FMC Corp. near Pocatello, and the higher grade phosphate rock was shipped to the Simplot fertilizer manufacturing plant also near Pocatello. Sand and gravel production was 1.7 million tons, compared with 569,000 tons in 1961. Increased use at State highway department road projects accounted for most of the rise. A small tonnage of basalt was used at State highway projects.

Blaine.—Federal Resources Corp. continued exploration and development of the Silver Star-Queens mine near Bellevue, under an agreement with Silver Star-Queens Mines, Inc. Work consisted of 500 feet of raising, 1,893 feet of drifting, 400 feet of diamond drilling, and 650 feet of long-hole drilling. Ore (139 tons) smelted at the International Smelting & Refining Co. lead smelter, Tooele, Utah, yielded 3,988 ounces of silver, 35 tons of lead, and 4 tons of zinc.

Dump material shipped from two Warm Springs district mines—Homestake and Silver Star—was milled in the Mexico-Pacific Mining Co. mill near Ketchum. Production from the Homestake property consisted of 1,000 tons of ore, which yielded 1,579 ounces of silver, 23 tons of lead, and 3 tons of zinc. Ore (2,000 tons) from the Silver Star dump contained gold (18 ounces), silver (7,564 ounces), copper (1 ton), lead (27 tons), and zinc (20 tons).

Small quantities of silver ore were mined at the Liberty Gem F. W. Eisele) and Silver King (Viking Exploration Co.) mines.

J. R. Simplot Co. shipped crude barite from stocks at the Sun Valley mine near Hailey to the company grinding plant at Pocatello. Sand and gravel output was much greater than that of 1961 because larger quantities were utilized at Bureau of Public Roads and U.S. Forest Service projects underway in the county.

Boise.—Small quantities of gold and silver ore were produced from the Come Back mine (Howes, Evans, and King), Boise Basin district; Blue Ridge mine (Blue Ridge Mining Co.), Grimes Pass district; and the Golden Cycle (H. F. Dye) and King mines (Schmitke, Day, and DeChambeau), Summit Flat district. Gold mill cleanings from the James mill, Banner district, yielded a minor amount of gold. Nineteen ounces of gold and 2 ounces of silver were recovered from the Ashcroft No. 2 placer by Fred Bell and Jack Woods.

Bonner.—Three tons of rich (743 ounces per ton) silver ore was mined at the Brown Bear property, Lakeview district, by M. Hines and A. J. Mask. A small quantity of lead-zinc ore came from the Hope mine, Clark Fork district, and silver ore was extracted at the Austin-Meyer Corp. Weber mine, Lakeview mining district. Federal Resources Corp. continued exploration and development at the Conjecture mine. Plans were made to reactivate a 100-ton-per-day mill on the property providing sufficient reserves were developed.

An interpretation of a map of eastern Bonner County was made.[8]

Bonneville.—Feather Placers dragline dredged 21,500 yards of gravel, which yielded 131 ounces of gold and 3 ounces of silver; this operation in the Pine Creek district was the largest gold placer operation in the State.

Production of 3 million tons of sand and gravel (378,000 tons in 1961) placed the county first as the producing area for these commodities. Sharply expanded demand for road gravel in State highway construction projects was the principal reason for the increase, but larger quantities of sand and gravel used by the county highway department also contributed. The county continued to be the leading pumice-producing area despite a considerable reduction in tonnage. Clay for manufacturing building brick was mined near Idaho Falls,

[8] Savage, C. N. Geomagnetics and Geologic Interpretation of a Map of Eastern Bonner County. Idaho Bureau of Mines and Geol. Inf. Circ. No. 15, August 1962, 16 pp.

and output increased substantially. Utah-Idaho Sugar Co. burned limestone to quicklime for use at its Idaho Falls sugar refinery. A small quantity of basalt was quarried near Idaho Falls for use at State highway department works.

Boundary.—Tira Mall Mining Co. produced lead ore from the Idaho Continental mine in the Port Hill mining district. Northwest Prospecting & Development Co. reported that diamond drilling at the Hall Mountain property, north of Bonners Ferry, indicated 20,000 tons of near-surface ore containing an estimated 750 tons of thorium oxide (ThO_2).

Caribou.—Kermac Nuclear Fuels Corp., a subsidiary of Kerr-McGee Oil Industries, Inc., began constructing a 750-ton-per-year vanadium pentoxide (V_2O_5) recovery plant near Soda Springs. The plant, which was expected to begin operating in mid-1963, was to utilize ferrophosphorus slag produced at the nearby Monsanto Chemical Co. electric-furnace operation.

Phosphate rock was mined at the Ballard properties (Monsanto Chemical Co.) and at the Conda mine (J. R. Simplot Co.). Rock from the Ballard operation was reduced to elemental phosphorus at the Soda Springs electric-furnace plant of Monsanto Chemical Co., and production from the Conda mine was shipped by rail to the Pocatello fertilizer plant of J. R. Simplot Co. Output from both the Conda and Ballard properties increased. San Francisco Chemical Co. shipped a small tonnage of phosphate rock from stocks at the Diamond Gulch lease north of Montpelier; the mine remained idle throughout 1962. Quartzite for flux at elemental-phosphorus plants was quarried near Soda Springs. Sand and gravel was produced for use at State and Federal road projects.

Clearwater.—A study of the geology of a portion of the county, with emphasis on the relationships between the Idaho batholith and bordering rocks, was completed.[9]

Custer.—In terms of value, the Clayton Silver Mines Clayton mine, Bayhorse district, was the principal metal mine. Approximately 20,700 tons of ore from the 500 and 800 levels was milled, from which 34 ounces of gold, 124,691 ounces of silver, 17 tons of copper, 575 tons of lead, and 108 tons of zinc were recovered. Payments were received for lead and zinc produced under the Government lead and zinc mining stabilization program. In April, economic conditions forced the suspension of a winze-sinking project, a reduction in the number of employees, and confinement of mining to the higher grade zones. At yearend, a new ore shoot on the 700 intermediate level was developed. Net smelter return on lead shipments averaged 6.86 cents per pound.

In the Alder Creek district, 6 tons of lead was produced from the Veteran & Silver Queen property, and R. V. Lloyd & Co. produced a sizable quantity of copper ore from the Empire Group. Gold mill cleanings were shipped from the Dudley mine property, Stanley Basin district. Two other lode mines—Ausich and Phi Kappa—were operated. A small quantity of gold and silver was recovered by small-scale hand placer methods from the Crazy Logger and Yankee Fork placers in the Yankee Fork district.

[9] Hietanen, Anna. Metasomatic Metamorphism in Western Clearwater County, Idaho. Geol. Survey Prof. Paper 344A, 1962, pp. A1–A116.

A road to the Tungsten Jim mine was improved and a new bridge built in an effort to make the road passable throughout the year.

Gem.—Gem State Consolidated Mines, Inc. (Dewey Group), the only metal-producing operation in the county, mined 882 tons of ore that yielded 828 ounces of gold, 1,730 ounces of silver, 3 tons of lead, and 2 tons of zinc.

Idaho.—Three lode mines were operated—Mammoth (gold-silver), Crown Point (gold), and Blue Bell (gold). Mill tailings shipped from the Wild Hope property yielded 19 ounces of gold. Idaho Mining & Milling Co. (Florence Basin placers) produced 122 ounces of gold and 48 ounces of silver from a bucketline-dredge operation in the Florence district. In the Orogrande district, gold was recovered from the Pixie No. 1 placer. Robert Newcomb produced 45 ounces of gold and 12 ounces of silver from the Maloney Creek placer.

Jerome.—Minor quantities of gold were recovered at two small-scale hand placer operations in the Snake River district.

Kootenai.—Commonwealth Silver, Inc., was awarded a $46,640 contract by OME for a silver-copper exploration project; Government participation was to be $23,320. Federal Resources Corp. completed an agreement with Commonwealth Silver and carried out a diamond-drilling program.

Latah.—J. R. Simplot Co. produced clay for paper and refractory uses at the Miclasil plant near Bovill. Raw material for the plant was mined from nearby clay-silica deposits by the Simplot firm. Silica sand was produced as a byproduct. Fire clay was mined near Helmer for use at the Troy plant of A. P. Green Firebrick Co. A small quantity of hand-cobbed mica was recovered from the Lucky Jim property near Deary and shipped to the GSA mica-purchase depot at Custer, S. Dak. for rifting and trimming. Sand and gravel and crushed stone for construction and road uses also were produced.

Lemhi.—Production of copper ore from the Black Pine mine (Toll Mining Co. and Western Uranium Corp.), Blackbird district, accounted for most of the county metal production value. Ore was processed at the company mill, trucked to the railhead at Mackay, and shipped by rail to the Tacoma (Wash.) smelter. The concentrates contained approximately 26 percent copper plus gold and silver values.

Approximately 3 tons of lead was produced at the Digmore mine, Junction district, and lead ore was mined at the Rosebud and Mountain Boy mines in the Texas district. Copper ore was shipped from the Red Bird mine, Eureka district; Peacock mine, Leadore district; and the Copper Queen mine, McDevitt district. Nine ounces of gold and 37 ounces of silver were produced from the Gem & Grizzly Bear property, Pratt Creek district, and a small quantity of gold was obtained from the Bryan mine, Yellow Jacket district. The Ajax Gambler hydraulic placer operation, Pratt Creek district, recovered 7 ounces of gold and 1 ounce of silver.

American Metal Climax, Inc., conducted a drilling program at the Ima mine, which was leased by the company in 1961. Formerly the mine was operated for tungsten and the last recorded tungsten production was in 1958.

Oneida.—Perlite mined by Oneida Perlite Corp. at deposits north of Malad was sold to commercial expanding plants in the Western States and Canada. The firm also shipped expanded perlite. Pumice, for

lightweight-concrete aggregate, was mined from a pit near Malad by Hess Construction Co. Output was used chiefly for manufacturing lightweight concrete building block. Sand and gravel output increased sharply—the result of increased road building activity by the State highway department.

Owyhee.—A small-scale hand operation at the Indian Cove placer, Snake River district, yielded 5 ounces of gold.

Power.—Vitro Chemical Co., Salt Lake City, Utah, announced plans to modify the Salt Lake City plant to produce vanadium pentoxide. Raw material for the plant was to be vanadium-bearing ferrophosphorus from the FMC Corp. elemental-phosphorus-producing operation.

Phosphate rock mined in Bingham and Caribou Counties was utilized at two phosphate processing plants in the county. Completion of an expansion program by J. R. Simplot Co. late in 1961 resulted in increased consumption of phosphate rock for fertilizer manufacture at the company plant near Pocatello. Phosphatic shale mined at the Gay mine (J. R. Simplot Co.) near Fort Hall, Bingham County, was reduced to elemental phosphorus at the electric-furnace plant at FMC Corp., west of Pocatello. Elemental phosphorus was shipped to company phosphate-products plants in California and the Midwest.

Sulfuric acid was produced at a 400-ton-per-day-capacity plant by the J. R. Simplot Co. for use at the firm's Pocatello fertilizer works. Sulfur, the basic raw material used at the plant, was obtained from sulfur recovery plants in Montana and Wyoming.

Shoshone.—Seventeen mines in the county supplied 99 percent of the silver, lead, and zinc produced in the State, 68 percent, of the gold, and 89 percent of the copper. Mines in the county accounted for 98.7 percent of the value of base- and precious-metal output.

Early in 1962, operations at The Bunker Hill Co. lead smelter were curtailed from a 7- to a 6-day work week. The smelter was closed for 2 weeks in August because of inadequate concentrate receipts and for blast furnace repairs. The company experienced no difficulty in obtaining sufficient zinc concentrates to facilitate capacity operation at the electrolytic zinc plant.

A brief history of discoveries in the Coeur d'Alene area and a basis for future exploration were outlined.[10]

The Bunker Hill Co. continued producing fertilizer-grade phosphoric acid at a 300-ton-per-day-capacity plant near Kellogg. Phosphate rock requirements were purchased from producers in Wyoming. Sulfuric acid, the other principal raw material, was supplied from a company-operated sulfuric acid facility nearby. The phosphoric acid plant was operated intermittently to meet seasonal demands.

Beaver District—Lessees continued to operate the Mountain Goat mine (Day Mines, Inc.) and a sink-float plant built in 1961. Subsidy payments were received as a small lead-zinc operator under Public Law 87-347.

Evolution District—The Sunshine mine continued as the largest domestic silver-producing mine despite the loss of 5-week's production because of a labor strike. The 135,786 tons of ore mined yielded 207

[10] Farmin, Rollin, and Garth M. Crosby. Extending Reserves in the Coeur d'Alene District. Min. Cong. J., v. 24, No. 1, January 1962, pp. 23–26.

ounces of gold, 4,655,278 ounces of silver, 725 tons of copper, 2,024 tons of lead, and 188 tons of zinc. Approximately 157,000 tons of waste material was removed from the mine during the year. Silver content of the ore increased from an average of 32.46 ounces per ton in 1961 to 35.07 ounces per ton. According to the annual report to shareholders, ore reserves on December 31, were 4,500 tons more than the 355,200 tons reported at the end of 1961. Sunshine received the "Underground Mine of 1962" award from Mining World magazine in recognition of its efficient mining methods. Exploration and development included 8,573 feet of drifting, raising, and sinking and 9 diamond-drill holes totaling 12,258 feet. Average operating costs during 1962 were $32.44 per ton. Sunshine and Silver Dollar Mining Co. received premium payments for lead produced in the Unit Area under the Government lead and zinc stabilization program.

Hecla Mining Co. produced 724,115 ounces of silver and 153 tons of copper from 27,547 tons of ore mined at the Silver Summit mine. Ore reserves were 6,836 tons at yearend. The Hecla annual report to shareholders indicated that continuous operation of the mine through 1963 was unlikely.

Hunter District—Hecla Mining Co. operated the Lucky Friday Silver-Lead Mines Co. Lucky Friday mine without interruption. The company mined and milled 181,133 tons of ore assaying 20.6 ounces of silver per ton, 12.0 percent lead, and 1.2 percent zinc, according to the Hecla annual report to shareholders. Ore reserves declined nearly 80,000 tons to 1,125,307 tons. Deepening the main shaft was begun late in 1962; the objective was to develop a level 200 feet below the 3050 level. The operation of the Lucky Friday mill was the subject of a report.[11]

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, in terms of recoverable metals

Year	Mines producing		Material sold or treated (thousand short tons)	Gold lode and placer (troy ounces)	Silver lode and placer (thousand troy ounces)
	Lode	Placer			
1953–57 (average)	38	--------	1,686	2,083	13,716
1958	25	--------	1,337	2,363	15,615
1959	17	1	1,422	2,349	16,461
1960	22	1	980	2,591	13,459
1961	15	1	1,434	3,279	17,369
1962	17	1	1,537	3,959	17,578
1884–1962	--------	--------	(1)	435,200	652,777

Year	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value (thousands)
1953–57 (average)	2,733	64,373	55,895	$46,020
1958	3,884	52,488	49,532	38,645
1959	3,678	61,155	55,454	44,058
1960	2,606	41,692	36,639	33,153
1961	3,673	70,651	58,184	46,313
1962	3,435	83,339	62,713	51,085
1884–1962	106,000	6,626,000	2,208,000	1,916,450

[1] Complete data not available: 1904–62, 108,042,382 short tons.

[11] Craig, J. Gordon. Lucky Friday's New Mill. Min. World, v. 24, No. 3, March 1962, pp. 28–32.

Hecla Mining Co., which owned a 30-percent interest (Bunker Hill owns 70 percent) in production from the Star mine and the adjoining Morning mine (American Smelting and Refining Co.), operated the Star Unit area under an agreement completed in 1961. All ore was transported to the surface through the Star mine. The Hecla annual report stated:

> The development work on the Star 6700 level was completed during the year, and stoping of the main vein was started in both the Star and Morning sections. Winze shaft sinking was completed to a point 137 feet below the 6900 station and lateral development of the 6900 level is presently underway.

Hecla announced yearend ore reserves of 747,847 tons.

Lelande District—The Day Mines, Inc., Hercules mine was not operated, but lead and zinc concentrates, which had been mined, processed, and stockpiled in 1959, were sold during 1962. Salvage of the Day Mines Hercules-Sherman plant at Burke was continued.

Placer Center District—Three mines were operated during 1962—Dayrock, Galena, and Interstate-Callahan. Day Mines, Inc., closed the Dayrock mine in August, after operations had been curtailed since 1960. The mine was maintained for possible future operation. The Interstate-Callahan lease from Day Mines produced a substantial tonnage of zinc ore. A 3-month trial operation at the Interstate mine determined that extraction of ore from previously stoped areas was not profitable under existing market conditions.

The Galena mine maintained its position as the second largest domestic silver mine by yielding 4,497,000 ounces, according to the Callahan Mining Corp. annual report to stockholders. The report also stated that the 133,000 tons of ore mined supplied nearly 1,764 tons of copper. Concerning development, the Day Mines annual report stated:

> The Galena mine, operated under a long-term lease by Asarco (75 percent interest) and DMI (25 percent interest), produced at capacity during 1962. Continued development of the North vein embraced the 3700 and 4000 levels; the ore was narrow in width but rich in grade as contrasted with the Silver vein. Additional new ore was developed on #134 vein at 3400 and 3200 levels, where it is a short distance north of the Silver vein. The new No. 3 shaft, for ventilation and possible future production, was extended nearly to the 3000 level, its present objective.

As a result of development, Galena mine ore reserves were increased to an equivalent of more than 6 year's operation at the 1962 rate. The grade of concentrate was raised from 27 to 30 percent copper by installing a regrind ball mill at the Galena mill.

Smelter District—The Bunker Hill Co. resmelted 41,121 tons of zinc-dump slag that yielded 16,693 ounces of silver, 35 tons of copper, 1,136 tons of lead, and 4,419 tons of zinc. In addition to the metal content, the slag was valued as a fluxing agent.

Summit District—Lessees mined and shipped lead-zinc ore from the Bear Top mine, the only active lode operation in the district. A minor amount of gold was recovered from old tailings at the Three Queens mine by placer-mining methods.

Yreka District—The Bunker Hill Co. and four lessees (Bailey, Marr, McLin, and Thompson) increased production from the Bunker Hill mine over that of 1961. The annual report stated that 2,235,484 ounces of silver, 38,918 tons of lead, and 18,378 tons of zinc were recovered from 521,914 tons of ore. Yearend ore reserves were 1,738,061

tons, a 26-percent decline from the 1961 figure. Sections of ore were removed from reserve categories because they were unprofitable to mine under existing economic conditions. Work continued on a 5-year accelerated development program that was initiated in 1961. A crosscut from the 3100 level of the Crescent mine was being driven to connect with a 23 level heading from the Bunker Hill mine. At yearend, the headings were about 1 mile apart. In February, fire destroyed a mill in Wardner Gulch operated by Frank Marr. Bunker Hill lease ore formerly was concentrated at the mill, the replacement cost of which was estimated at $300,000. The loss resulted in all Bunker Hill lease ore being sent to the Bunker Hill concentrator for processing. A sand-fill system, installed at the Bunker Hill mine in 1961, was described.[12]

Lead-zinc ore was mined at the Page property by American Smelting and Refining Co. Improved milling resulted from changes in the flotation circuits at the mill.

The Crescent mine yielded 32,476 tons of ore from which 856,126 ounces of silver was recovered, according to The Bunker Hill Co. annual report. Yearend ore reserves were 48,713 tons. Beginning in October, silver ore from the Crescent mine was milled in the Bunker Hill concentrator at Kellogg. The ore previously was processed in the Polaris mill near Osburn. To facilitate milling the ore, a new grinding and flotation circuit and ore bin were installed at the concentrator.

Silver Equipment Sales, Inc., produced a small quantity of lead and zinc from mill cleanings obtained during the scrapping of the Highland-Surprise mill. Mill cleanings also were shipped from the Liberal King mill. Percy Kitchen shipped zinc ore and mill cleanings from the Sidney property.

Valley.—The two dredges of Porter Bros. Corp. in Bear Valley remained idle. Nine ounces of gold and nine ounces of silver were recovered from the Dewey placer, Thunder Mountain district.

Antimony Gold Ores Co. mined antimony ore by selective strip mining at various properties belonging to the company and to United Mercury Co. in the Yellow Pine district. The principal claims worked were the Antimony Ridge and Sugar Creek. Seven men were employed in mining and milling during the summer. Approximately 86 tons of the antimony shipped to W. R. Grace & Co. was used for manufacturing flame-proofing chemicals and compounds, and the remainder was consumed in manufacturing ammunition.

T. R. Baugh, Boise, was granted an OME loan to prospect for mercury in Bear Valley. Government participation was to be one-half of the $18,510 contract.

Washington.—An exploration program at the Idaho-Almaden mine, near Weiser, was carried out in an effort to discover mercury ore of sufficient grade to merit reopening the mine. Iron ore was shipped from two mines—Campbell (Joe Holcomb) and Cudahy Mountain (George Budock).

Shipments of gypsum for agricultural uses were made from stocks at the Rock Creek mine (Rock Island Gypsum Co.) northwest of Weiser. The mine was idle throughout 1962.

[12] Park, M. A. Automated Sand Fill System. Min. Cong. J., v. 48, No. 10, October 1962, pp. 24–26.

The Mineral Industry of Illinois

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Illinois Geological Survey, for collecting information on all minerals except fuels.

By Matthew G. Sikich [1] and L. G. Marshall [2]

MINERAL output in Illinois in 1962 reached a record high of $588.3 million, nearly 4 percent more than the value in 1961 and slightly more than the previous $586.4 million record in 1960. Increases in total values of production of portland cement, coal, fluorspar, lime, natural gas, petroleum, sand and gravel, stone, tripoli (amorphous silica), and zinc offset decreases for masonry cement, clays, lead, natural gas liquids, and peat. A new high in production of sand and gravel was established. The major commodity group was mineral fuels supplying 74 percent of the State total value. Nonmetals furnished 25 percent, and metals, 1 percent.

TABLE 1.—Mineral production in Illinois [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland—thousand 376-pound barrels	8,595	$28,301	9,145	$30,205
Masonry—thousand 280-pound barrels	461	1,420	440	1,320
Clays—thousand short tons	1,982	4,166	1,929	4,151
Coal (bituminous)—do	45,246	177,070	48,487	186,986
Fluorspar—short tons	116,908	5,956	132,830	6,392
Lead (recoverable content of ores, etc.)—do	3,430	707	3,610	664
Natural gas—million cubic feet	9,970	1,276	10,650	1,523
Natural gas liquids:				
Natural gasoline and cycle products—thousand gallons	16,956	1,311	13,315	1,023
LP gases—do	340,284	16,495	327,616	13,812
Peat—short tons	6,597	30	(2)	(2)
Petroleum (crude)—thousand 42-gallon barrels	76,818	229,686	[3] 77,325	[3] 230,429
Sand and gravel—thousand short tons	31,353	35,098	34,122	38,981
Stone—do	36,361	47,939	41,293	54,411
Zinc (recoverable content of ores, etc.)—short tons	26,795	6,163	27,413	6,305
Value of items that cannot be disclosed: Gem stones, lime, tripoli, and values indicated by footnote 2		11,775		12,133
Total		[4] 567,393		588,335

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Preliminary figure.
[4] Revised figure.

[1] Supervisory mineral economist, Bureau of Mines, Minneapolis, Minn.
[2] Mining engineer, Bureau of Mines, Minneapolis, Minn.

Illinois produced a variety of minerals. In 1962 the State led in fluorspar production, ranked fourth in bituminous coal output, and was among the leading States in producing construction minerals—cement, clays, lime, sand and gravel, and stone. Illinois also ranked high in the processing of mineral raw materials.

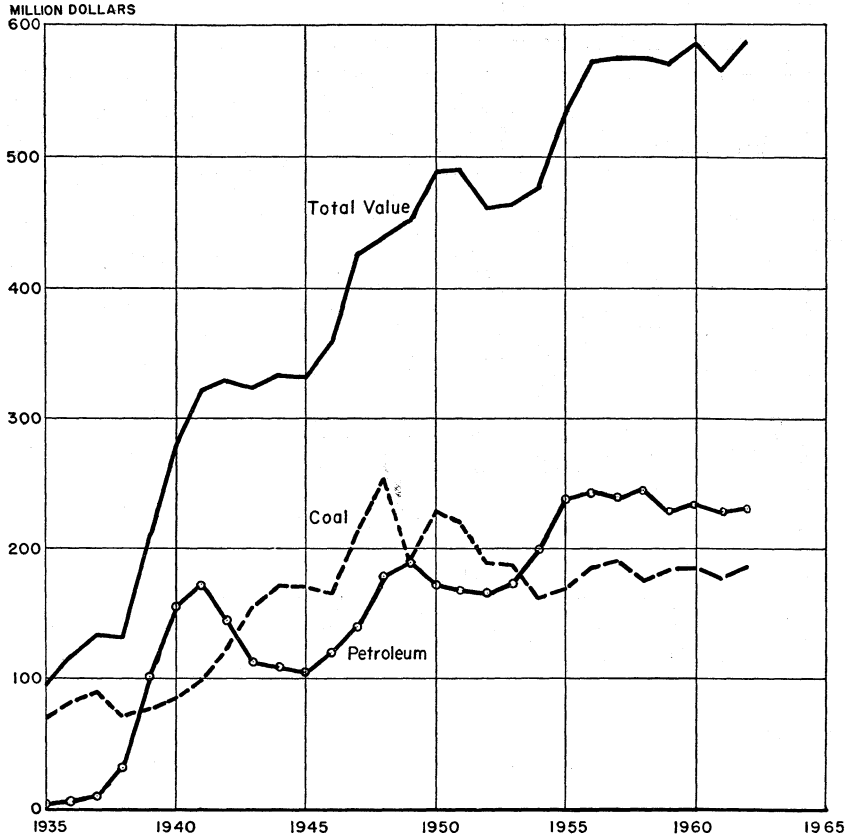

FIGURE 1.—Value of coal, petroleum, and total value of mineral production in Illinois, 1935–62.

Employment and Injuries.—Nearly 34.6 million man-hours were worked in Illinois mineral industries in 1962, excluding the petroleum industry and all officeworkers. This represented a 3-percent increase over the final figure of 33.4 million man-hours recorded for 1961. Employment gains in the cement and bituminous coal industries and increased statistical coverage of clay-processing plants were chiefly responsible for the overall increase.

Twenty-three fatalities, 21 in the coal-mining industry and 1 each at limestone and sand and gravel operations, occurred in 1962 compared with 8 in 1961. Eleven of the fatalities occurred January 10 in a gas and dust explosion at the Mine No. 2 of the Blue Blaze Coal Co. near

Herrin. Total number of nonfatal disabling injuries decreased to 908 (preliminary figure) compared with the final figure of 943 in 1961.

Table 2 contains a summary of employment and injury data for selected State mineral industries. Certain industries are excluded from the table, primarily to avoid disclosing individual company confidential data.

TABLE 2.—Employment and injuries for selected mineral industries [1]

Year and industry	Average number of men working	Total man-hours	Total number of disabling injuries		Total number of days lost or charged	Injury frequency rate [2]	Injury severity rate [3]
			Fatal	Nonfatal			
1961:							
Cement [4]	829	2,166,301	--------	2	(5)	.92	(5)
Clay [6]	1,144	1,999,824	--------	74	1,260	37.00	630
Coal (bituminous)	8,983	15,029,376	7	569	72,852	38.32	4,847
Coke ovens	573	1,671,130	--------	6	(5)	3.59	(5)
Fluorspar	535	1,035,747	--------	35	983	33.79	949
Limestone [7]	2,440	4,806,385	--------	133	(5)	27.67	(5)
Sand and gravel	1,954	3,639,710	1	66	13,696	18.41	3,763
Smelters	978	2,232,941	--------	41	1,197	18.36	536
1962: [8]							
Cement [4]	977	2,371,334	--------	2	149	.84	63
Clays [6]	1,436	2,623,259	--------	55	2,015	20.97	768
Coal (bituminous)	8,555	15,414,674	21	554	163,529	37.30	10,609
Coke ovens	550	1,608,565	--------	14	(5)	8.70	(5)
Fluorspar	494	974,772	--------	41	1,033	42.06	1,060
Limestone [7]	2,403	4,772,976	1	113	18,991	23.88	3,979
Sand and gravel	2,129	3,822,098	1	81	16,601	21.45	4,343
Smelters	858	2,181,875	--------	31	1,020	14.21	467

[1] Excludes officeworkers.
[2] Total number of injuries per million man-hours.
[3] Total number of days lost or charged per million man-hours.
[4] Includes cement plants and quarries or pits producing raw material used in manufacturing cement.
[5] Data not available.
[6] Excludes pits producing clay used in manufacturing cement.
[7] Excludes quarries producing limestone used in manufacturing cement and lime.
[8] Preliminary figures.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Illinois maintained its rank as the fourth largest coal-producing State in the Nation with an output of 48.5 million short tons. The chief reason for a 7-percent gain in production, compared with 1961, was the 2.5-million-ton increase in consumption by electric power utilities. Approximately 29.7 million tons of coal mined in the State in 1962 was used in producing electrical energy. Total shipments to general manufacturing and processing industries and domestic consumers also gained. Shipments to coke and gas plants increased to 914,000 tons, 25 percent more than in 1961. Sales for railroad fuel declined slightly to about 364,000 tons. Nearly 73 percent of the 39.3 million tons of bituminous coal consumed in Illinois in 1962 was mined within the State. Average mine value was $3.86 per ton, compared with $3.91 in 1961.

Coal was produced from 109 mines in 34 counties, compared with 114 mines in 37 counties in 1961. Data exclude mines producing less

than 1,000 tons annually. Major producing counties, in order of decreasing production, were Williamson, Christian, Fulton, Franklin, St. Clair, Saline, Perry, Jefferson, Knox, Montgomery, Randolph, Vermilion, Peoria, and Jackson. Eleven companies produced over 1 million tons each and together they furnished 89 percent of the total output. Four Illinois mines were among the 10 largest producing mines in the Nation.

TABLE 3.—Coal (bituminous) production in 1962, by counties

(Excludes mines producing less than 1,000 short tons)

County	Number of mines operated		Production (short tons)			Value
	Underground	Strip	Underground	Strip	Total	
Adams		1		42,904	42,904	$299,569
Bureau		1		290,263	290,263	(1)
Christian	1		5,266,166		5,266,166	(1)
Douglas	1		(1)		(1)	(1)
Franklin	3		4,887,527		4,887,527	(1)
Fulton		16		5,128,403	5,128,403	20,838,933
Gallatin	2		73,633		73,633	247,240
Greene		1		4,508	4,508	24,493
Grundy		1		379,408	379,408	(1)
Henry	1		92,309		92,309	(1)
Jackson	1	2	75,238	944,953	1,020,191	(1)
Jefferson	1	1	2,611,654	18,481	2,630,135	(1)
Kankakee		1		23,611	23,611	(1)
Knox		3		2,120,818	2,120,818	(1)
Logan	1		20,552		20,552	102,760
Macoupin	1		318,096		318,096	1,292,969
Madison	2		(1)		(1)	(1)
Marion	1		16,558		16,558	62,140
Menard	1		7,657		7,657	46,281
Mercer	1	1	65,034	3,700	68,734	206,202
Montgomery	1		2,038,301		2,038,301	(1)
Peoria	3	7	26,638	1,032,783	1,059,421	5,254,097
Perry		2		3,367,193	3,367,193	(1)
Randolph	1	2	851,546	1,066,779	1,918,325	(1)
St. Clair	4	3	1,123,434	3,678,459	4,801,893	17,235,503
Saline	2	8	1,392,841	2,097,741	3,490,582	13,278,716
Sangamon	2		81,907		81,907	409,535
Schuyler		1		507,909	507,909	(1)
Stark		1		488,388	488,388	(1)
Vermilion	3	2	43,800	1,050,250	1,094,050	(1)
Wabash		1		2,583	2,583	10,668
Washington	1		24,127		24,127	(1)
Will		1		332,594	332,594	(1)
Williamson	12	7	3,778,570	2,003,323	5,781,893	21,986,754
Total	46	63	23,902,311	24,585,051	48,487,362	186,985,587

[1] Figure withheld to avoid disclosing individual company confidential data; included in total.

Strip mines supplied 51 percent of the total production, and underground mines the remainder. Output from strip mines was 8 percent more than in 1961, and output from underground mines was 7 percent more than in 1961.

Nearly 91 percent of the total production was cleaned at 54 plants. All but a fraction of a percent of the underground production was cut by machines and mechanically loaded. Loading equipment included 104 mobile loaders, 43 continuous miners, and 5 duckbills or self-loading conveyors. Stripping and loading equipment at strip mines included 150 power shovels and draglines (including wheel excavators). About 80 percent of the total State output was shipped to consumers

by rail, 11 percent by truck, and 9 percent by waterways. A small quantity was consumed at the mines.

In November, Delta Coal Corp. began production at its new Sun Spot strip mine near Vermont, in Fulton County. In mid-1962, Peabody Coal Co. began producing coal from the Midwest underground mine near Millstadt. Truax-Traer Coal Co. was merged into Consolidation Coal Co., Inc.

On January 10, a gas and dust explosion caused the deaths of 11 men at the Mine No. 2 of the Blue Blaze Coal Co. near Herrin.

Coke.—Approximately 1,917,000 short tons of coke valued at $36.4 million was produced at five plants, compared with 1,841,000 tons valued at $35.4 million in 1961. About 1,811,000 tons was used by producing companies in blast furnaces. Over 154,000 tons of coke breeze valued at $1,044,000 was recovered at coke plants. Nearly 81,000 tons of coke breeze was used by producers in agglomerating iron ore. Other products of coke-oven plants included coke-oven gas, ammonia, tar, crude light oil, and light-oil derivatives. The coke ovens of Youngstown Sheet & Tube Co. remained inactive during 1962.

Peat.—Production of peat decreased substantially. Output was reported by two companies in Cook and Kane Counties. Types of peat produced were reed-sedge and humus. Although classed as a mineral fuel, peat was used principally for soil conditioning.

Petroleum, Natural Gas, and Natural Gas Liquids.—Crude petroleum output increased less than 1 percent and comprised 39 percent of the total value of mineral production. Oilfields in southeastern part of the State supplied most of the production. Waterflood oil production continued to increase, accounting for about two-thirds of the total output. According to the Illinois State Geological Survey, 1,839 wells were completed in 1962, of which 881 were producing oil wells, 20 were gas wells, 526 were dry holes in pools, and 412 were unsuccess-

TABLE 4.—Crude petroleum production, by fields [1]

(Thousand barrels)

Field	1958	1959	1960	1961	1962 [2]
Albion	1,377	1,113	888	863	772
Benton	606	529	467	442	565
Centralia	3,480	2,160	1,420	995	1,238
Clay City	7,972	7,269	7,470	6,683	6,495
Dale	2,485	1,979	2,506	3,136	2,852
East Inman	1,537	1,126	746	495	593
Johnsonville	992	1,698	1,438	1,433	1,720
Loudon	13,158	12,586	12,628	13,356	14,925
New Harmony	4,430	4,758	5,252	5,246	5,333
Old Illinois (Bridgeport, Casey and Robinson-Stoy)	8,035	9,461	12,225	12,483	11,275
Phillipstown	691	606	653	622	665
Roland	2,155	1,860	1,545	1,304	1,175
Sailor Springs	1,531	1,378	1,382	1,281	1,216
Salem	6,475	6,926	8,482	9,659	10,590
Other fields [3]	25,351	23,278	20,239	18,820	17,911
Total	80,275	76,727	77,341	76,818	77,325

[1] Based on Oil and Gas Journal data adjusted to Bureau of Mines total.
[2] Preliminary figures.
[3] Bureau of Mines figures.

ful wildcats. Total footage drilled was 3,883,900, of which 51 percent was in producing wells. Data do not include service wells, natural-gas storage wells, or old wells worked over. Estimated proved crude-oil reserves on December 31, were 460 million barrels, according to the American Petroleum Institute.

Marketed production of natural gas increased 7 percent in quantity and 19 percent in value. Output of liquefied petroleum gases decreased 4 percent in quantity and 16 percent in value. Production of natural gasoline decreased 21 percent in quantity and 22 percent in value. According to the American Gas Association, estimated proved recoverable reserves of natural gas liquids were 5.0 million barrels at yearend.

NONMETALS

Cement.—Portland and masonry cements were produced by four companies with plants in LaSalle and Lee Counties. Shipments of portland cement increased 6 percent in quantity and 7 percent in total value. Average value per barrel increased slightly to $3.30. Sales to ready-mixed concrete companies and highway contractors increased 11 and 6 percent, respectively. Decreases were recorded in sales to concrete product manufacturers and building material dealers. More than 96 percent of the portland cement produced consisted of types I and II (general-use and moderate-heat); the remainder, high-early-strength and special use types. Sales of masonry cement declined 4 percent in quantity and 7 percent in value.

Ninety-two percent of the total portland cement output was shipped in bulk and 8 percent in bags. Two-thirds of the total shipments were by truck and one-third by rail.

About 78 percent of the portland cement and 51 percent of the masonry cement shipments were distributed within the State. Wisconsin was the next largest consumer, followed by Iowa, Indiana, Minnesota, Missouri, and Michigan in that order. The annual finished portland-cement capacity of Illinois plants was 10.9 million barrels.

A total of 2.6 million tons of limestone was quarried for use in manufacturing portland cement. Other raw materials consumed included 186,000 tons of clay and shale, 47,000 tons of gypsum and lesser amounts of sand, slag, anhydrite, and other materials.

TABLE 5.—Finished portland cement produced and shipped

(Thousand barrels and thousand dollars)

Year	Active plants	Production	Shipped from mills	
			Quantity	Value
1953-57 (average)	4	8,828	8,628	$23,484
1958	4	9,433	9,205	29,308
1959	4	9,559	9,486	30,158
1960	4	9,270	8,770	29,321
1961	4	8,757	8,595	28,301
1962	4	9,081	9,145	30,205

Cement distributing plants with combined capacity of 220,000 barrels were constructed by Alpha Portland Cement Co. at Chicago and Huron Portland Cement Co. and Marquette Cement Manufacturing

Co. at Waukegan. Construction of the new cement plant of Missouri Portland Cement Co. near Joppa continued. Production was expected to begin in 1963.

Clays.—Total production of fire clay and miscellaneous clay and shale was 3 percent less in quantity than in 1961 with less than 0.5 percent drop in value. The major use of both types of clays was for manufacturing heavy clay products which accounted for 53 percent of the fire-clay production and nearly 57 percent of the miscellaneous clay and shale production. Consumption of fire clay for heavy clay products increased 42 percent, whereas output of miscellaneous clay and shale for heavy clay products declined 10 percent. Consumption of miscellaneous clay and shale for lightweight aggregate increased less than 0.5 percent.

Clay sales were 171,173 short tons, valued at $1,135,000. Clay used was 1,757,891 tons, valued at $3,016,000. Production was reported from 26 counties. Fire clay was produced in 9 counties by 12 companies.

The addition of a third kiln increased the production capacity of Material Service Division of General Dynamics Corp. plant at Ottawa.

TABLE 6.—Clays sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Fire clay		Miscellaneous clay		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	385	$1,222	1,785	$3,017	2,170	$4,239
1958	725	2,733	1,610	3,177	2,335	5,910
1959	322	2,158	1,908	2,792	2,229	4,950
1960	359	2,378	1,997	3,101	2,357	5,479
1961	263	1,764	1,719	2,402	1,982	4,166
1962	317	1,737	1,612	2,414	1,929	4,151

Fluorspar.—Illinois ranked first among 6 fluorspar-producing States, supplying 64 percent of the total domestic output. Shipments increased 14 percent in quantity and 7 percent in total value. Sales of acid grade and ceramic grade increased substantially whereas sales of metallurgical grade decreased. About 71 percent of the output was acid grade, 26 percent was ceramic grade, and 3 percent was metallurgical.

The leading producers were the Aluminum Company of America, Minerva Oil Co., and Ozark-Mahoning Co. About 401,000 tons of crude ore was processed at Hardin County mills to produce 128,134 tons of finished fluorspar. Some byproduct lead and/or zinc concentrates were also produced.

The Minerva Oil Co. closed the Jefferson mine and mill and opened the Fairbairn mine. A number of parcels of land in Hardin County were optioned by the Reynolds Metals Co. International Minerals & Chemical Corp. initiated a diamond-drill exploration program on Hicks Dome.

Gem Stones.—Glacial agates, fluorspar, and other mineral specimens were obtained principally for private collections by individuals.

Lime.—Total production of quick and hydrated lime increased 3 percent in both quantity and value. The total State production came from plants operated by three companies in Adams and Cook Counties. Nearly 60 percent of the output was for refractory use, 35 percent for chemical and industrial uses, and 5 percent for construction. A small quantity was sold for agriculture.

Perlite.—Crude perlite from Colorado and New Mexico was processed by five companies in Champaign, Cook, De Kalb, Kankakee, and Will Counties. Processed material sold or used was substantially more than in 1961. About 34 percent was used for filter aid, 30 percent as lightweight aggregate in plaster and concrete, and 27 percent as loose fill insulation. The remainder was used as a soil conditioner and a filler, among other purposes. Initial production of expanded perlite was reported by the U.S. Perlite Corp., which operated a plant in Kankakee County. Lake Zurich Concrete Products Co. discontinued producing expanded perlite at its plant in Lake County.

Sand and Gravel.—Illinois ranked fourth in the Nation both in quantity and value of sand and gravel production. A new high in State output was established. Total production was 34.1 million short tons valued at $39 million, an increase of 9 percent in quantity and 11 percent in value over that of 1961 and representing a 3-percent gain in tonnage over the previous record set in 1960. Demand for sand and gravel for building purposes increased 24 percent above that of 1961. Output for paving increased 1 percent. Sales of industrial sands were 2.8 million tons, an increase of nearly 7 percent over the 1961 sales. Output for railroad ballast and fill increased substantially.

Of the total output, 56 percent was used for paving and 27 percent was used for building purposes. About 87 percent was shipped by truck, 11 percent by rail, and the remainder by water.

Production was reported from 75 counties and more than 1 million tons each were produced in Bureau, Grundy, Kane, Lake, LaSalle, McHenry, Peoria, Tazewell, Will, and Winnebago Counties. Major producers included Chicago Gravel Co., Consumers Co., Crystal Lake Trucking & Excavating Co., Elmhurst-Chicago Stone Co., Illinois-Wisconsin Sand & Gravel Co., McGrath Sand & Gravel Co., Inc., Manley Sand Division of Martin Marietta Corp., Material Service Division of General Dynamics Corp., Ottawa Silica Co., C. A. Powley Co., and Wedron Silica Co.

Stone.—With the exception of a small quantity of sandstone from Alexander County used for refractory purposes, total production consisted of limestone. Both quantity and value were 14 percent more than in 1961. Of the total production, about 79 percent was used for roadstone and concrete aggregate, 9 percent for agricultural purposes, and 6 percent for the manufacture of cement. All three categories recorded substantial increases over those of 1961. Nearly 94 percent of the crushed and broken stone was shipped by truck, and 6 percent by rail. A small quantity was shipped by water.

TABLE 7.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Glass	1,338	$3,172	1,438	$3,381
Molding	626	2,300	384	1,051
Building	4,367	4,279	5,124	4,570
Paving	6,910	6,489	7,149	6,558
Railroad ballast	22	17	129	142
Engine	(1)	(1)	19	18
Filtration	(1)	(1)	10	26
Fill	862	528	1,432	748
Ground	216	1,982	745	5,223
Undistributed [2]	523	1,835	308	1,473
Total	[3] 14,866	[3] 20,600	[3] 16,737	23,190
Gravel:				
Building	3,121	3,007	4,164	3,890
Paving	11,361	10,169	10,869	10,395
Railroad ballast	111	71	93	94
Fill	658	396	674	407
Other	398	335	323	255
Total	[3] 15,650	13,978	16,123	15,041
Total sand and gravel	30,516	34,578	[3] 32,861	38,231
Government-and-contractor operations:				
Sand:				
Building			7	5
Paving	114	56	244	122
Fill			1	(4)
Total	114	56	252	127
Gravel:				
Building	7	4		
Paving	707	456	1,009	623
Fill	9	4	1	(4)
Total	723	464	1,010	623
Total sand and gravel	837	520	[3] 1,261	750
All operations:				
Sand	14,980	20,656	16,989	23,316
Gravel	16,373	14,442	17,133	15,664
Grand total	31,353	35,098	34,122	[3] 38,981

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes sand for grinding and polishing (1961); fire or furnace, oil (hydrafrac), and other uses (1961–62); and blast (1962).
[3] Data do not add to totals shown due to rounding.
[4] Less than $500.

TABLE 8.—Limestone sold or used by producers, by uses

Use	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Dimension:				
Rough construction and flagging thousand short tons	20	$133	(1)	(1)
House-stone veneer thousand cubic feet	29	100	(1)	(1)
Total approximate thousand short tons [2]	23	233	18	$167
Crushed and broken:				
Riprap thousand short tons	890	909	319	386
Concrete aggregate and roadstone do	27,237	36,169	32,747	43,398
Railroad ballast do	269	268	293	294
Agriculture do	3,414	5,030	3,713	5,334
Asphalt do	163	449	107	465
Cement do	2,441	1,711	2,565	1,773
Other [3] do	1,923	3,165	1,530	2,588
Total do	36,337	47,701	[4] 41,275	[4] 54,237
Grand total do	36,360	47,934	[4] 41,292	[4] 54,405

[1] Figure withheld to avoid disclosing individual company confidential data; included in total.
[2] Average weight of 170 pounds per cubic foot used to convert cubic feet to short tons.
[3] Includes limestone for chemical uses, filler, lime, metallurgical, and other purposes combined to avoid disclosing individual company confidential data.
[4] Data do not add to total shown because of rounding.

Limestone was produced in 62 counties and 65 percent of the total came from 9 counties—Cook, Kankakee, La Salle, Lee, Livingston, Randolph, Rock Island, St. Clair, and Will. Leading producers included Allied Chemical & Dye Corp., Columbia Quarry Co., Consumers Co., Dolese & Shepard Co., East St. Louis Stone Co., Elmhurst-Chicago Stone Co., Lehigh Stone Co., Marquette Cement Manufacturing Co., Material Service Division of General Dynamics Corp., and Mississippi Lime Co.

Sulfur.—Elemental sulfur recovery declined 17 percent in quantity and 3 percent in value. The Anlin Company of Illinois recovered sulfur by the Amine Gas Purification and Modified Claus processes at its plant in Madison County. The Pure Oil Co. used the Modified Claus process at its Will County plant.

Tripoli (Amorphous Silica).—Producers of tripoli, or amorphous silica, were Ozark Minerals Co. and Tamms Industries Co., both in Alexander County. Production of crude ore increased 9 percent in quantity. Total sales of prepared material, used for abrasives, filler, and other purposes, increased 9 percent in quantity and 14 percent in value.

Vermiculite.—Crude ore shipped from Montana, South Carolina, and South Africa was processed by Zonolite Co., Mica Pellets, Inc., and International Vermiculite Co. at plants in Cook, De Kalb, and Macoupin Counties, respectively. Shipments were virtually the same in quantity as in 1961, and value decreased 1 percent. Processed material was used essentially for insulation and concrete and plaster aggregate. No exfoliated vermiculite was produced at the Johns-Manville Perlite Corp. plant in Will County during 1962. Zonolite Co. was acquired by W. R. Grace & Co. at the close of the year.

METALS

Lead and Zinc.—Production of lead and zinc, in terms of recoverable metals, increased 5 percent and 2 percent, respectively, in quantity over that of 1961. Increased production from the southern Illinois fluorspar district, recovering lead and zinc as byproducts, offset a drop in output from lead-zinc mines in the northern Illinois district. Total value of lead production decreased 6 percent, whereas value of zinc production increased 2 percent.

Principal producers of lead and zinc in northern Illinois (Jo Daviess County) were Eagle-Picher Co. and Tri-State Zinc, Inc. Both companies operated their mines and mills throughout the year. Major producers in southern Illinois (Hardin and Pope Counties) were Aluminum Company of America, Minerva Oil Co., and Ozark-Mahoning Co.

Average weighted yearly prices used to calculate total values of lead and zinc production in 1962 were 9.2 cents per pound for lead and 11.5 cents per pound for zinc. Prices in 1961 were 10.3 cents for lead and 11.5 cents for zinc.

TABLE 9.—Mine production of silver, lead, and zinc, in terms of recoverable metals

Year	Mines producing	Materials sold or treated [1] (short tons)	Silver		Lead		Zinc		Total value
			Troy ounces	Value	Short tons	Value	Short tons	Value	
1953–57 (average)	20	769,804	1,631	$1,476	3,594	$1,036,158	19,381	$4,707,183	$5,744,817
1958	19	1,003,020	--------	--------	1,610	376,740	24,940	5,087,760	5,464,500
1959	22	930,265	--------	--------	2,570	591,100	26,815	6,167,450	6,758,550
1960	22	1,015,581	--------	--------	3,000	702,000	29,550	7,623,900	8,325,900
1961	20	965,541	--------	--------	3,430	706,580	26,795	6,162,850	6,869,430
1962	17	970,900	--------	--------	3,610	664,240	27,413	6,304,990	6,969,230

[1] Data include fluorspar ore from which lead and/or zinc were recovered as follows: 1953, 353,570 tons; 1954, 202,478 tons; 1955, 309,311 tons; 1956, 336,635 tons; 1957, 360,406 tons; 1958, 401,562 tons; 1959, 297,252 tons; 1960, 380,395 tons; 1961, 368,283 tons; and 1962, 399,742 tons.

TABLE 10.—Mine production of lead and zinc, by months in terms of recoverable metals

(Short tons)

Month	Northern Illinois		Southern Illinois		Total Illinois	
	Lead	Zinc	Lead	Zinc	Lead	Zinc
January	130	1,635	190	830	320	2,465
February	75	1,635	125	680	200	2,315
March	50	1,260	220	740	270	2,000
April	65	1,495	210	840	275	2,335
May	105	1,575	250	1,010	355	2,585
June	65	1,515	325	795	390	2,310
July	40	1,450	250	965	290	2,415
August	70	1,175	225	890	295	2,065
September	50	1,220	210	900	260	2,120
October	50	1,355	270	928	320	2,283
November	70	1,376	250	877	320	2,253
December	67	1,375	248	892	315	2,267
Total	837	17,066	2,773	10,347	3,610	27,413

Pig Iron and Steel.—Nearly 4.8 million short tons of pig iron was shipped from Illinois blast furnaces or consumed by producing companies, approximately the same amount as in 1961. Estimated value of output was $282.2 million. Five companies operated blast furnaces in Chicago and Granite City. The three blast furnaces of Youngstown Sheet & Tube Co. were idle throughout 1962. Three other blast furnaces in the State were inactive the entire year; 15 were out of blast part of the year; and only 1 operated throughout 1962.

About 6.6 million short tons of domestic iron and manganiferous ores (excluding agglomerates) was consumed in Illinois blast and steel furnaces and agglomerating plants. In addition, over 1 million short tons of iron-ore pellets, produced at or near mine sites outside Illinois, and 509,000 tons of foreign iron ore (including 116,000 tons of sinter from Canada) were consumed in Illinois furnaces. Over 3 million tons of sinter was produced at consuming furnaces. Approximately 4.2 million short tons of agglomerates (sinter and pellets), 3.5 million tons of coke, and 1.8 million tons of limestone and dolomite were consumed. Data for nonintegrated steel plants are not included.

According to the American Iron & Steel Institute, steel production was 8,635,758 short tons, 3 percent more than in 1961. Steel furnaces were operated by 13 companies.

Other Metals.—Refined thorium compounds were manufactured from monazite concentrate by the American Potash & Chemical Corp. at West Chicago. The company also produced rare-earth compounds.

Some ores mined in the State contained small but valuable quantities of certain metals, such as cadmium, gallium, and germanium, which were recovered in later processing stages at plants in Illinois or other States.

REVIEW BY COUNTIES

Mineral production, excluding liquid fuels and natural gas, was reported in 97 of the 102 counties in 1962. La Salle County continued in first place with mineral output of $36.4 million. Other leading counties with mineral output exceeding $10 million were Christian, Cook, Franklin, Fulton, Jefferson, Lee, Perry, St. Clair, Saline, and Williamson. Total value of mineral production increased for 65 counties and decreased for 32.

Some counties are not included in the text of this section. All producing counties in 1962 and the minerals they produced (except for liquid fuels and natural gas), are listed in table 11. The value of sand and gravel and stone production that could not be credited to a county source is included under "Undistributed."

Adams.—Limestone was produced for various uses from three underground mines and three quarries. The underground mines were operated by the Black White Limestone Co., Marblehead Lime Co. (Division of General Dynamics Corp.), and Menke Stone & Lime Co. Quarries were operated by the Western Illinois Stone Co., which produced from their No. 7 and No. 8 quarries having closed No. 9 quarry, and by the Missouri Gravel Co. Quick and hydrated lime were also produced by Marblehead Lime Co. and Menke Stone & Lime Co.

TABLE 11.—Value of mineral production in Illinois, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value
Adams	$1,871,602	$2,141,948	Stone, lime, coal, sand and gravel.
Alexander	221,034	222,725	Tripoli, sand and gravel, stone.
Bond	214,104	244,153	Sand and gravel, stone, clays.
Boone	(2)	160,560	Sand and gravel, stone.
Brown	93,750	129,672	Stone, clays, sand and gravel.
Bureau	2,100,483	2,333,585	Coal, sand and gravel, clays.
Calhoun	461,347	103,792	Stone, sand and gravel.
Carroll	218,203	220,961	Do.
Cass	1,150	9,729	Sand and gravel.
Champaign	303,067	325,114	Do.
Christian	(2)	(2)	Coal, stone.
Clark	626,803	616,739	Stone, sand and gravel.
Clay	184,200	(2)	Stone.
Clinton	331,641	(2)	Stone, sand and gravel.
Coles	(2)	686,367	Do.
Cook	26,598,892	29,975,905	Stone, lime, sand and gravel, clays, peat.
Crawford	134,456	121,384	Sand and gravel.
Cumberland	122,403	(2)	Sand and gravel, stone.
De Kalb	441,194	529,980	Stone, sand and gravel.
De Witt	(2)	(2)	Sand and gravel.
Douglas	(2)	(2)	Coal.
Du Page	(2)	(2)	Stone, sand and gravel.
Edwards	60,810	22,140	Clays.
Effingham	22,800		
Fayette	86,423	194,988	Stone, sand and gravel, clays.
Ford	(2)	184,780	Sand and gravel, stone.
Franklin	(2)	(2)	Coal.
Fulton	20,738,818	21,278,961	Coal, sand and gravel.
Gallatin	565,797	412,525	Do.
Greene	452,725	516,058	Stone, clays, coal.
Grundy	(2)	5,324,577	Sand and gravel, coal, clays.
Hancock	286,564	417,903	Stone, sand and gravel.
Hardin	8,816,092	9,717,325	Clays, zinc, lead, stone.
Henderson	272,382	321,969	Stone.
Henry	(2)	907,517	Stone, coal, sand and gravel.
Iroquois	3,609	(2)	Sand and gravel.
Jackson	(2)	(2)	Coal, stone, sand and gravel.
Jefferson	(2)	(2)	Coal, stone.
Jersey	201,960	(2)	Stone.
Jo Daviess	(2)	4,463,231	Zinc, stone, lead, sand and gravel.
Johnson	1,098,089	987,042	Stone, sand and gravel.
Kane	2,508,572	2,814,933	Sand and gravel, stone, peat.
Kankakee	3,712,536	2,340,064	Stone, clays, coal, sand and gravel.
Kendall	(2)	306,445	Sand and gravel, stone.
Knox	(2)	(2)	Coal, stone, sand and gravel.
Lake	1,205,651	1,347,871	Sand and gravel, clays.
La Salle	33,711,134	36,432,025	Cement, sand and gravel, stone, clays.
Lawrence	293,320	230,990	Sand and gravel.
Lee	(2)	(2)	Cement, stone, sand and gravel, clays.
Livingston	1,927,472	2,217,613	Stone, clays, sand and gravel.
Logan	594,564	692,823	Sand and gravel, stone, coal.
Macon	(2)	(2)	Sand and gravel.
Macoupin	1,290,286	1,292,969	Coal.
Madison	4,151,915	3,915,198	Coal, stone, sand and gravel.
Marion	91,590	(2)	Stone, coal.
Marshall	304,891	238,527	Sand and gravel, clays.
Mason	21,484	(2)	Sand and gravel.
Massac	(2)	(2)	Clays, stone, sand and gravel.
McDonough	295,408	352,646	Stone, clays.
McHenry	2,775,330	2,973,520	Sand and gravel, stone.
McLean	579,216	552,904	Sand and gravel.
Menard	675,587	(2)	Stone, coal, clays.
Mercer	313,152	378,202	Coal, stone, clays, sand and gravel.
Monroe	(2)	(2)	Stone, sand and gravel.
Montgomery	(2)	(2)	Coal, stone.
Moultrie	13,593		
Ogle	1,546,477	1,751,383	Sand and gravel, stone.
Peoria	6,557,595	7,553,387	Coal, sand and gravel, stone.
Perry	(2)	(2)	Coal.
Piatt	(2)	(2)	Sand and gravel.
Pike	457,234	643,550	Stone, sand and gravel.
Pope	88,393	37,280	Sand and gravel.
Pulaski	271,956	(2)	Stone, sand and gravel, clays.
Putnam	8,793	2,494	Sand and gravel.
Randolph	6,960,359	7,713,545	Coal, stone, sand and gravel.
Rock Island	1,502,447	2,185,727	Stone, sand and gravel, clays.
St. Clair	19,896,385	21,091,864	Coal, stone, sand and gravel, clays.
Saline	11,964,354	13,278,716	Coal.
Sangamon	910,380	968,805	Sand and gravel, coal, clays.

See footnotes at end of table.

TABLE 11.—Value of mineral production in Illinois, by counties[1]—Continued

County	1961	1962	Minerals produced in 1962 in order of value
Schuyler	(2)	(2)	Coal, sand and gravel, stone.
Scott	(2)	$343,611	Stone, clays, sand and gravel.
Shelby	$181,509	(2)	Stone, sand and gravel.
Stark	(2)	(2)	Coal, sand and gravel.
Stephenson	260,740	286,443	Stone, sand and gravel.
Tazewell	(2)	1,626,282	Sand and gravel, clays.
Union	753,695	951,452	Stone, sand and gravel.
Vermilion	6,034,299	5,938,797	Coal, stone, clays, sand and gravel.
Wabash	198,204	212,688	Sand and gravel, coal.
Warren	(2)	(2)	Stone.
Washington	(2)	(2)	Stone, coal.
Wayne	(2)		
White	190,764	184,883	Sand and gravel.
Whiteside	280,025	377,113	Stone, sand and gravel.
Will	7,659,732	7,921,964	Stone, sand and gravel, coal.
Williamson	23,530,606	21,990,223	Coal, sand and gravel.
Winnebago	2,318,707	2,088,679	Sand and gravel, stone.
Woodford	(2)	183,760	Sand and gravel.
Undistributed	[3] 354,822,561	352,343,636	
Total	[3] 567,393,000	588,335,000	

[1] Excludes gem stones, petroleum, natural gas, natural gas liquids, and some stone and sand and gravel for which data by counties are not available; included with "Undistributed." The following counties did not report production: Edgar, Hamilton, Jasper, Morgan, and Richland.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.

Blick's Sand Co. and Quincy Sand Co. produced sand and gravel from stationary plants near Quincy for building, paving, fill, and other uses. Some paving sand and gravel was produced under contract for the Hancock County Highway Department and the State highway department.

Coal was produced by the Triple S Mines, Inc., from a strip mine near Augusta. Total output of 43,000 tons was for local consumption. Half the total production was cleaned by jigging and treated with oil.

Alexander.—Tripoli (amorphous silica) was produced by the Ozark Minerals Co. and the Tamms Industries Co. from underground mines near Elco and Tamms. The material was sized, ground, and cleaned at company-operated mills, bagged, and shipped to consumers mainly by rail. Sales of prepared material increased 9 percent in quantity and 14 percent in total value.

Sand and gravel produced by H. H. Halliday Sand Co., operating a dredge near Cairo, was for building, paving, and railroad ballast. Paving gravel was produced by the county highway department.

The Western Firebrick Co. mined sandstone from an underground mine near Elco principally for use as a refractory. The material was shipped by rail to the company plant at Granite City for processing.

Bond.—Sand and gravel was produced by Greenville Gravel Co., Inc., and Pruitt & Basler from stationary plants near Greenville. Cyril Munie produced from both stationary and portable plants near Pocahontas. The material mined was used for building, road construction, and fill.

The Richards Brick Co. produced miscellaneous clay near New Douglas for manufacturing building brick at its plant near Edwardsville, Madison County. Limestone for road construction and agricultural use was produced by the Bond Stone Co. from their quarry near Sorento.

Boone.—Sand and gravel was produced by Belvidere Blacktop Co., Inc., and Vincent Spencer Sand & Gravel Co. near Belvidere and also by Fred Smith near Capron. Output was for building, road construction, and fill. The State and county highway departments contracted for paving sand and gravel.

The Belvidere Stone Co., Belvidere, produced crushed limestone for roadstone and agricultural use from a quarry formerly operated by the Belvidere Lime Co. The latter company was dissolved March 1. Charles Lee & Sons operated a limestone quarry near Kirkland, producing material for agricultural and road purposes.

Brown.—Missouri Gravel Co. and Brown County Stone Co. produced crushed limestone from quarries near Mount Sterling. Output was for roadstone and agricultural use. Frederic Brick & Tile Co. produced miscellaneous clay for manufacturing draintile at its plant near Mount Sterling. Brown County Stone Co. produced sand and gravel chiefly for building and road construction at their stationary plant near Mount Sterling.

The Big Four Coal Co. mined less than 1,000 tons of coal from a strip mine near Mount Sterling for local consumption.

Bureau.—The Midland Electric Coal Corp. operated a strip mine near Mineral. The entire output was treated at the company plant which also cleaned coal from the Midland Collieries, Inc., Victoria No. 5 mine in Knox County. Shipments were primarily by rail.

About 1,342,000 tons of sand and gravel was produced in the county. Output was reported by nine commercial operators, the county highway department, the city of Princeton, and under contract for the State highway department and the Henry County Highway Department. The material was for building, road construction, fill, and molding use. Production was from fixed and portable plants, chiefly near Buda, New Bedford, Princeton, Seatonville, Sheffield, Spring Valley, Walnut, and Wyanet. Sheffield Shale Products Co. produced miscellaneous clay near Sheffield for building brick and other heavy clay products.

Calhoun.—Crushed limestone was produced by three companies operating quarries near Batchtown, Belleview, and Golden Eagle. Output was for roadstone, agricultural use, and riprap. The Magnesium Lime Co. did not operate its quarry in 1962. Sand and gravel was produced by two companies operating portable plants near Michael and Batchtown.

Carroll.—Approximately 201,000 tons of crushed limestone was produced by 4 companies operating 10 quarries. Output was for roadstone and agricultural use. The quarry operated by Minor Brothers was acquired by Charles Eller on August 1. Heisler Gravel Co. produced 32,000 tons of sand and gravel at a stationary plant near Mt. Carroll, for road construction, building, and fill.

Champaign.—The Ryolex Corp. expanded crude perlite mined in New Mexico at its Champaign plant for use as a plaster additive. Sand and gravel for building construction, paving and fill was produced by four companies at portable and stationary plants near Champaign, Mahomet, and Ludlow.

Christian.—Coal was mined near Pawnee by Peabody Coal Co. at its No. 10 underground mine. Production increased 15 percent over 1961.

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The mine was the second largest bituminous coal producer in the United States. About 96 percent of the total output was shipped by rail. Forty-seven percent of the production was cleaned by jigging. Tri County Stone Co. produced crushed limestone near Nokomis for concrete aggregate, roadstone, and agricultural limestone.

Cook.—The value of mineral production increased 13 percent to nearly $30 million. Limestone led in quantity and value, with over 13 million tons. Producers were Consumers Company, Division of Vulcan Materials Co., with quarries near McCook, Lemont, and Hillside; Material Service Division of General Dynamics Corp., with quarries near McCook, Lyons, Chicago, and Thornton; Dolese & Shepard Co., operating near Hodgkins; and R. P. Donohoe Co. and Elroy & Son, operating quarries near Lemont. The processed stone was marketed as concrete aggregate, roadstone, metallurgical flux, railroad ballast, agricultural limestone, flagging, and for other uses.

Lime was produced at three plants by two companies. Marblehead Lime Co. produced quicklime and hydrated lime at its South Chicago and Thornton plants. The Standard Lime & Cement Co., Division of Martin Marietta Corp., produced quicklime at its operations near McCook.

Approximately 769,000 tons of sand and gravel production was reported. The producers included Chicago Gravel Co., operating its Hammonds stationary plant; Doetsch Brothers, producing from three pits; Material Service Division of General Dynamics Corp., operating two pits; Worth Sand & Gravel Co., Inc., operating a fixed plant near Worth. Road Materials Corp. was idle in 1962.

About 391,000 tons of clay was mined for manufacturing building brick. Operators were the Brisch Brick Co., Stickney; Carey Brick Co., Chicago; Chicago Brick Co., Riverdale and Blue Island.

Peat humus was mined near Barrington by Henry Frenzer for soil conditioning. All the material was sold in bulk.

Blast and steel furnaces and coke-oven plants were operated in the Chicago area. Pig-iron producers included Interlake Iron Corp., International Harvester Co., Republic Steel Corp., and United States Steel Corp. All except the latter company operated coke ovens in the county. Blast furnaces and coke ovens of Youngstown Sheet & Tube Co. remained inactive throughout 1962. Steel-producing companies included Acme Steel Co., Borg-Warner Corp., Ceco Steel Corp., Columbia Tool Steel Co., A. Finkl & Sons Co., H. M. Harper Co., International Harvester Co., Republic Steel Corp., and United States Steel Corp.

Refined thorium compounds and rare-earth compounds were manufactured by the American Potash & Chemical Corp. at West Chicago.

Crude perlite mined in New Mexico was processed by the Silbrico Corp. at its Hodgkins plant for use in building plaster, loose fill insulation, concrete aggregate, soil conditioning, filler, and paint texture.

Crude vermiculite from Montana and South Carolina was processed by the Zonolite Co. at its Chicago plant. Late in 1962, Zonolite Co. was acquired by W. R. Grace & Co. The U.S. Mica Co. produced ground mica from South Dakota scrap mica at its Forest Park plant.

The Pure Oil Co., Lemont, recovered elemental sulfur from its refinery gases by the Modified Claus process.

Alpha Portland Cement Co. began to operate a distribution center at Chicago.

De Kalb.—Approximately 294,000 tons of sand and gravel was produced chiefly for building and road construction. Output was reported by four companies. The State highway department contracted for paving gravel. Crushed limestone for roadstone and agricultural use was produced by two companies, near Cortland and Fairdale.

Mica Pellets, Inc., produced exfoliated vermiculite from crude material mined in Montana and expanded perlite from Colorado crude material at its De Kalb plant.

Douglas.—Moffat Coal Co. produced coal from their underground mine at Murdock. Three-fifths of the output was shipped by railroad. The entire output was cleaned by jigs.

Du Page.—Crushed limestone was produced by the Elmhurst-Chicago Stone Co. at their Elmhurst plant for concrete aggregate, roadstone, and agricultural purposes. The company also produced sand and gravel for building and road purposes at stationary plants at Bartlett and Warrenville.

Edwards.—The Albion Brick Co. mined miscellaneous clay near Albion for manufacturing building brick. The company plant was idle in January, February, and March.

Fayette.—Winter's Stone Quarry reported initial production of limestone from a quarry near Ramsey. Output was for roadstone and agriculture. Sand and gravel was produced by three companies operating stationary plants near Vandalia, Hagarstown, and Mulberry Grove. The material was used for building, road construction, molding sand, and fill. The Diller Shale Products Co. mined miscellaneous clay and shale for the manufacture of heavy clay products at the St. Elmo plant.

Franklin.—Coal production increased 29 percent to 4.9 million tons. Production was from three underground mines, the Orient No. 5 of Freeman Coal Mining Corp. and Nos. 9 and 21 mines of Old Ben Coal Corp. These mines were near Benton, West Frankfort, and Sesser, respectively. The output was treated at three plants. Heavy-media, tables, jigs, and pneumatic methods were utilized in processing. Ninety-seven percent of the total production was shipped by railroad.

Fulton.—The county ranked third in total coal production and first in output from strip mines. Production of 5.1 million tons was 3 percent greater than in 1961. The entire output was from 16 strip mines. Ninety-nine percent of the output was cleaned at seven plants. Of the total production, 53 percent was shipped by barge on the Illinois River; 39 percent, by rail; and the remainder, by truck. Jones Coal Co., Taylor Coal Co., and Delta Coal Co. began operating new mines in 1962. The Truax-Traer Coal Co. became a Division of Consolidation Coal Co., Inc., in June. Operations of the Big Ten Coal Co. stopped in January. Two companies produced sand and gravel for building, road construction, and other uses.

Gallatin.—About 74,000 tons of coal was produced by two companies, operating underground mines near Junction and Sparks Hill. Of the total output, 75 percent was shipped by barge on the Ohio River.

No crushing, treating, or mechanical cleaning was done at the mines. Paving sand and gravel was produced by Delta Materials Co. at their portable plant near Shawneetown. The State and county highway departments produced and/or contracted for paving sand and gravel. The Gail Denny Sand Co. discontinued operations.

Greene.—American Vitrified Products Co. produced plastic fire clay and miscellaneous clay near White Hall for use in manufacturing vitrified sewer pipe. Eddie Geldner produced flint fire clay near Roodhouse for manufacturing brick. Three companies, operating near East Hardin, Hillview, and Kane, produced limestone for roadstone, riprap, and agricultural purposes. One operation was underground.

The Birch Creek Coal Co., Roodhouse, produced 4,500 tons of coal, a decline of 30 percent from 1961. The output was almost entirely consumed locally.

Grundy.—Approximately 379,000 tons of coal was produced by Peabody Coal Co. from a strip mine near Wilmington. The mine extends into Kankakee and Will Counties. The entire output was mechanically cleaned at the company plant in Will County. About two-thirds of the production was shipped by truck, and the remainer by rail.

The Illinois Clay Products Co. produced about 86,000 tons of plastic fire clay near Coal City primarily for manufacturing refractories.

Material Service Division, General Dynamics Corp. produced paving sand near Morris.

Hardin.—Shipments of finished fluorspar increased 14 percent in quantity and 7 percent in value. Shipments of acid grade increased 9 percent and ceramic grade 43 percent, whereas sales of metallurgical grade decreased 33 percent. Major producing companies were the Aluminum Company of America, Minerva Oil Co., and Ozark-Mahoning Co.

Aluminum Company of America continued to operate its group of mines and mill near Rosiclare. Acid-grade fluorspar and lead and zinc concentrates were produced at the mill. Minerva Oil Co. operated its Crystal group and No. 1 mines and mills. The company began production at its new Fairbairn mine; ore from this mine was treated at the Crystal mill. The company closed its Jefferson mine. Fluorspar, lead, and zinc concentrates were produced at the Crystal mill. Fluorspar and zinc concentrates were produced at the No. 1 mill. Some custom ore was processed at both plants. Ozark-Mahoning Co. operated mines near Cave-in-Rock and a mill at Rosiclare, producing fluorspar, lead, and zinc concentrates. Tamora Mining Co. operated a fluorspar mine and mill leased from Rosiclare Lead & Fluorspar Mining Co. The mine and mill were closed in October. Other companies operating fluorspar mines included Goose Creek Fluorspar Mining Co. and Hoeb Mining Co. Ore from their mines was processed at plants of other companies. Some fluorspar mined in the county was processed in Kentucky, and a small quantity of fluorspar mined in Kentucky was processed in Hardin County.

Crushed limestone for roadstone and agriculture was produced near Cave-in-Rock and Elizabethtown.

Henry.—Coal was produced by Shuler Coal Co. from an underground mine near Alpha. Production decreased 4 percent from 1961. Shipments were mainly by railroad.

Crushed limestone for roadstone was produced near Cleveland by the Cleveland Quarry, Inc., formerly McCarthy Improvement Co. Sand and gravel was produced for building construction, paving, fill, and foundry uses from one portable and two stationary plants, near Kewanee, Colona, and Cleveland. The State highway department contracted for paving sand.

Jackson.—About 1 million tons of coal was produced, a 7-percent decrease from 1961. Most of the production was from the Burning Star strip mine of Truax-Traer Coal Division, Consolidation Coal Co., Inc., near Elkville. The entire output from the mine was cleaned at the Burning Star No. 2 plant of the company in Perry County. The company's Burning Star slope mine was not operated in 1962. Farley Bros. Coal Co. produced coal from a strip mine near De Soto. Elk Coal Co. operated an underground coal mine and preparation plant near Elkville.

Limestone was produced by Illinois Quarry Co. near Ava. The material was used for roadstone and agriculture. Sand and gravel for building, road construction, and other purposes was produced by Lawder Sand Co., operating a stationary plant near Grand Tower.

Jefferson.—Coal was produced by Freeman Coal Mining Corp. from the Orient No. 3 underground mine near Waltonville and by Belle Rive Mining Co., operating a strip mine near Belle Rive. Total production decreased 9 percent from 1961. The Orient No. 3 was the seventh largest producing bituminous coal mine in the Nation. Output from the mine was cleaned, using jigs, heavy-media, and pneumatic methods.

Limestone for roadstone and agriculture was produced by Randall Stone Co. at Mount Vernon.

Jo Daviess.—Production of lead decreased 31 percent and that of zinc decreased 7 percent. The Eagle-Picher Co. operated the Graham-Snyder-Spillane mine and the O'Rourke mine at Hazel Green. Ore from these operations and ore mined by Eagle-Picher in Wisconsin was concentrated by jigging, tabling, and flotation at the company's Graham mill. Some custom ore was also treated at the Graham mill. Tri-State Zinc, Inc., operated the Gray and Amelia mines near Galena. Ore from these mines was treated at the Gray mill.

About 389,000 tons of crushed limestone was produced for roadstone, railroad ballast, and agricultural purposes. Producers included Broege Limestone Co., operating a quarry near Warren; Rees Construction Co., operating five quarries; Rein, Schultz, & Dahl, Inc., operating quarries near Apple River and Dahinda; Elmer Wienen & Sons, operating six quarries; and Willowa Engineering Co., who shipped dolomitic limestone from two lead and zinc mine dumps.

Dubuque Sand & Gravel Co. produced sand and gravel at its stationary plant near East Dubuque for building, paving, and fill.

Kane.—Sand and gravel was produced by 12 companies. Output of nearly 3 million tons came from portable and stationary plants near Algonquin, North Aurora, Big Rock, East Dundee, Elburn, Elgin, Hampshire, Montgomery, and St. Charles. The material was used for building construction, paving, fill, and other purposes. Krahan Gravel Co. sold its holdings in December. The State highway department contracted for paving sand and gravel.

Limestone was produced by the Conco-Western Stone Co. near North Aurora and the Fox River Stone Co. and Rein, Schultz, & Dahl, Inc., near Elgin. Output of 291,000 tons was for roadstone, agricultural use, flagging, and rubble.

Reed-sedge peat was produced near Batavia by Batavia Soil Builders. Output was sold in bulk for soil conditioning.

Red iron oxide pigments were produced by George B. Smith Chemical Works, Inc., at its plant near Maple Park.

Kankakee.—Coal was produced by the Peabody Coal Co. at a strip mine near Wilmington. The mine extended into Grundy and Will Counties. Production from the Kankakee County portion of the mine decreased considerably from 1961. Output was cleaned by jigging.

Crushed limestone was produced by Lehigh Stone Co. near Kankakee and Manteno Limestone Co. near Manteno. Output was for roadstone, railroad ballast, and agriculture.

Clay was produced near Kankakee and St. Anne for manufacturing building brick and other heavy clay products. Producers were Eastern Illinois Clay Co., Kankakee Clay Products Co. (a division of Eastern Illinois Clay Co.), and St. Anne Brick & Tile Co.

About 24,000 tons of paving sand was produced by Kankakee Bank Sand Co., operating a stationary plant near Kankakee, and by Peabody Coal Co. near Wilmington. The sand and gravel operation of Azzarelli Construction Co. was idle in 1962.

The U.S. Perlite Corp. expanded perlite for use in acoustical ceiling tile at its plant near Momence. The crude material was mined in Colorado.

Knox.—Coal was produced by two companies at three strip mines. Production increased 3 percent from that of 1961. Midland Collieries, Inc., produced from the Victoria No. 5 mine near Victoria. Midland Electric Coal Corp. produced from the Middle Grove No. 2 and Rapatee No. 3 mines, both near Farmington. Coal mined by Midland Collieries, Inc., was cleaned at Midland Electric Coal Corp.'s Mineral No. 1 plant in Henry County. Midland Electric Coal Corp. processed their Knox County output at the Middle Grove No. 2 plant. Ninety-nine percent of the county production was shipped by rail.

Crushed limestone was produced by Abingdon Rock Co. near Abingdon for roadstone and agricultural purposes. Paving gravel was produced by Knox County Gravel Co.

Briggs Manufacturing Co., formerly Abingdon Potteries, Inc., produced ground feldspar at its Abingdon plant from crude material mined by the company in South Dakota. The plant output was used for making pottery.

Lake.—Sand and gravel was produced by 10 companies operating portable and stationary plants near Barrington, Gurnee, Ingleside, Libertyville, McHenry, Spring Grove, Wadsworth, and Wauconda. Total production was 1.9 million tons, an increase of about one-third over that of 1961. The material was used for building construction, paving, fill, and miscellaneous purposes. The State and county highway departments contracted for paving sand and gravel.

The National Brick Co. produced about 23,000 tons of miscellaneous clay near Deerfield for manufacturing building brick.

National Gypsum Co. manufactured gypsum products at their Waukegan plant from crude material mined by the company in Michigan.

Huron Portland Cement Co. constructed a 12-silo, 150,000-barrel cement distribution center and Marquette Cement Manufacturing Co. placed in operation a 62,000-barrel-capacity storage and distribution plant at Waukegan.

Lake Zurich Concrete Products Co. discontinued production of expanded perlite at its Lake Zurich plant.

No production of peat was reported in 1962.

General Motors Corp. produced coke for foundry use at Waukegan.

La Salle.—The county ranked first in value of mineral output (excluding liquid fuels and natural gas). Alpha Portland Cement Co., Lehigh Portland Cement Co., and Marquette Cement Manufacturing Co. produced portland and masonry cements. Each company quarried limestone for use in manufacturing cement. Crushed limestone was also produced for roadstone and agriculture by three companies near Sheridan, Troy Grove, and Utica.

Sand and gravel was produced by 14 companies at 17 operations. Total output was nearly 4 million tons. The material was for building and road construction, fill, glass manufacture, molding, sandblasting, filtering, oilfield fracturing, filler, enamel, pottery, abrasives, and foundry purposes. Producers of silica sands included The American Silica Sand Co., Inc., Arrowhead Silica Corp., Bellrose Silica Co. (formerly E. C. Bellrose Sand Co.), Ottawa Silica Co., and Wedron Silica Co. Blackhawk Silica Sand Co. began constructing a $1 million plant near Troy Grove for processing silica sand. The Illinois Silica Sand Co. operation was inactive in 1962. The State and county highway departments contracted for paving sand and gravel.

Shale was produced by Alpha Portland Cement Co. and Marquette Cement Manufacturing Co. for captive use in manufacturing cement. Material Service Division of General Dynamics Corp. produced shale for manufacturing lightweight aggregate at its plant on the Illinois River near Ottawa. Production capacity of the plant was increased by adding a third kiln. Conco-Meier Co. near Lowell and Hydraulic-Press Brick Co. near Utica mined clay and used the material for manufacturing building brick. Conco-Meier Co. converted all their kilns to natural gas. Fire clay was produced near Ottawa by Illinois Valley Minerals Co. and sold to steel mills for refractory use.

Matthiessen & Hegeler operated a zinc smelter at La Salle.

Lee.—Portland and masonry cements were produced by Medusa Portland Cement Co. at their Dixon plant. Limestone and clays were mined by the company for use in manufacturing cement. An article described the modernization of the company plant.[3]

Crushed limestone was produced by Frank N. Butler Co., Oregon Stone Quarries, Laurde Renner Limestone Co., Stoneridge Limestone Co., and Wastone, Inc. Processed material was for roadstone and agriculture.

Sand and gravel production was approximately 240,000 tons. The producing companies included C. C. Macklin with a portable plant near Stuart; Nelson Sand & Gravel Co., operating a stationary plant

[3] Rock Products. Medusa's Modernization Matures. V. 65, No. 9, September 1962, p. 89.

near Nelson; and Rock River Ready Mix Co., with a stationary plant near Dixon. Material was used for building, road construction, and fill. The State highway department contracted for paving gravel.

Livingston.—About 1.3 million tons of crushed limestone was produced near Chenoa and Pontiac. Output was for roadstone, agricultural purposes, asphalt filler, and riprap. Producers were Chenoa Stone Co., Livingston Stone Co., Ocoya Stone Co., Pontiac Stone Co., and Wagner Stone Co.

Miscellaneous clay was mined near Streator and Chatsworth by Diller Tile Co., Inc., Hydraulic-Press Brick Co., and Streator Clay Pipe Co. The material was used for manufacturing building brick, other heavy clay products, and vitrified sewer pipe. Howard Arnold Construction Co. and Valley View Dirt & Gravel Co. mined sand and gravel primarily for paving.

Logan.—Coal was mined by McSpadden Bros. at an underground mine near Lincoln. Production decreased 21 percent from 1961. The entire output was consumed locally. Limestone was quarried near Lincoln by Rocky Ford Limestone Co. for roadstone and agriculture. Lincoln Sand & Gravel Co. operated a dredge near Lincoln and produced sand and gravel for building and road construction, engine use, fill, and other purposes. John Allsopp and R. A. Cullinan & Son, Inc., produced paving gravel.

Macoupin.—Little Dog Coal Co. produced 318,000 tons of coal from an underground mine near Gillespie, an increase of 2 percent. Total output was cleaned by jigs and tables. About 81 percent of the output was shipped by rail, and most of the remainder was shipped by truck.

International Vermiculite Co. exfoliated vermiculite at its Girard plant using crude material mined in Montana. Output was chiefly for insulating purposes.

Madison.—Coal was produced from two underground mines, operated by Livingston-Mt. Olive Coal Co. near Livingston and Lumaghi Coal Co. near Collinsville. Both companies operated cleaning plants; one used heavy-media methods, and the other used jigs. About 89 percent of the production was shipped by truck, and most of the remainder was shipped by rail.

Limestone was produced by C. M. Lohr, Inc., Reliance Whiting Co., and Mississippi Lime Co. Mississippi Lime Company operated an underground mine. Output was for roadstone, agriculture, riprap, and other uses.

Sand and gravel, produced by several companies near Alton and Granite City, was used for building, road construction, foundry use, and other purposes. The State highway department contracted for paving gravel. Lewis & Clark Sand Co. acquired the Alton Sand Co. operations. Guth Sand Co. was sold to C. E. Barker.

Granite City Steel Co. operated blast and steel furnaces and coke ovens at Granite City. La Clede Steel Co. produced steel in open-hearth furnaces at Alton.

The Anlin Company of Illinois recovered sulfur by the Amine Gas Purification and Modified Claus processes at its Wood River refinery.

Marion.—Crushed limestone was produced by Moushon Construction Co. mainly for road construction.

Marion County Coal Mining Corp. produced nearly 17,000 tons of coal from an underground mine near Centralia. Output decreased about one-third from 1961.

Marshall.—Paving gravel was produced by Vernon Henry, near LaRose, Princeville Stone Co. near Henry, and Wilson's Gravel Pit near Lacon, all operating portable plants. The county highway department contracted for paving gravel.

Hydraulic-Press Brick Co. produced plastic fire clay near Sparland and used it to manufacture building brick.

Massac.—Illinois Clay Products Co. produced 7,000 tons of plastic fire clay at its Betz plant for use in foundries and steel works. Columbia Quarry Co. operated the Mermet No. 10 quarry near Belknap and produced crushed limestone for agricultural uses. About 3,100 tons of sand and gravel was produced by Metropolis Ready-Mix Concrete Co. near Metropolis. The State highway department contracted for paving gravel.

Construction work continued on the new cement plant of Missouri Portland Cement Co. near Joppa. Plans included the construction of a distribution center in the vicinity of the cement plant.

McHenry.—Sand and gravel was produced by 13 companies and the county highway department, operating portable and stationary plants near Alden, Algonquin, Crystal Lake, Harvard, Island Lake, Marengo, McHenry, and Woodstock. Major producers included Consumers Co., Crystal Lake Trucking & Excavating Co., Material Service Division of General Dynamics Corp., and Tonyan Bros., Inc. Total production in the county was 4.4 million tons. Output was for building and road construction, railroad ballast, and fill. Paving sand and gravel was produced under contract for the State and Lake County highway departments.

Garden Prairie Stone Co., Inc., produced limestone near Marengo for roadstone, agriculture, and flagging. The company also produced paving gravel.

Menard.—Limestone for use as roadstone and in agriculture was crushed at stationary plants near Athens by Athens Stone Quarry and Indian Point Limestone Products, Inc. Miscellaneous clay was produced by Springfield Clay Products Co. near Petersburg for manufacturing building brick. The plant and pit were sold to Petersburg Clay Products Co. in October.

New Salem Coal Co., Inc., produced coal from an underground mine near Petersburg. The production of nearly 7,700 tons decreased 28 percent below that of 1961. The entire output was locally consumed.

Mercer.—Total coal output was more than double that of 1961. About 69,000 tons was produced by Hazel Dell Coal Corp., from an underground mine near Alpha, and by Viola Materials, Inc., from a strip mine near Viola. The latter company acquired Viola Coal Co. in March. About three-fourths of the total production was shipped by rail, and the remainder was shipped by truck.

Limestone for concrete aggregate and roadstone was produced near Viola by Mercer County Stone & Coal Co. and Viola Materials, Inc.

Hydraulic-Press Brick Co. produced miscellaneous clay near Aledo and used the material for manufacturing building brick.

The State highway department contracted for paving sand and gravel.

Montgomery.—Freeman Coal Mining Corp. produced about 2 million tons of coal from the Crown underground mine near Farmersville. Production decreased 1 percent from that of 1961. The entire output was cleaned by jigging and pneumatic methods.

Approximately 516,000 tons of crushed limestone for concrete aggregate, roadstone, and agricultural purposes was produced near Nokomis and Litchfield by Central Illinois Stone Co., Inc., Chuck Johnson's Quarry, Nokomis Lime Quarry, and Rein, Schultz & Dahl, Inc.

Ogle.—Over 678,000 tons of sand and gravel was produced by stationary and portable plants near Byron, Forreston, Kings, and Oregon. Commercial producers included Byron Material Service, McGrath Sand & Gravel Co., C. C. Macklin, Manley Sand Division of Martin Marietta Corp., and Floyd Weigle. Output was for building and road construction, railroad ballast, fill, glass, molding, and pottery. Leaf River Township highway department produced paving gravel.

Nearly 470,000 tons of crushed limestone, an increase of 6 percent over that of 1961, was produced from quarries near Byron, Leaf River, Oregon, Polo, and Rochelle. Principal uses were for concrete aggregate, roadstone, and agricultural purposes. Producers included Byron Material Service, Kutz Brothers Co., McGrath Sand & Gravel Co., Macklin Bros., Oregon Stone Quarries, and Pine Creek Rock Co. The county highway department produced and contracted for limestone for road use.

Peoria.—Nearly 1.1 million tons of coal was produced, a 22-percent increase over that of 1961. Production was from seven strip mines and three underground mines. Producers were Gibson Coal Co., Layne's Coal Co., Morgan Coal Co., Sherwood-Templeton Coal Co., Inc., The United Electric Coal Cos., Big Bear Coal Co., Lightbody Coal Co., and Zaborac Coal Co. Layne's Coal Co. discontinued operations at its No. 2 mine and placed its No. 5 mine in operation. Ninety-five percent of the total county output was mechanically cleaned at three plants. Sixty-four percent was shipped by barge on the Illinois River.

About 1.5 million tons of sand and gravel was produced by seven companies, operating stationary and portable plants near Chillicothe, Kickapoo, and Peoria. Output was for building and road construction, railroad ballast, fill, and other purposes. Over 517,000 tons of crushed limestone was produced near Princeville by three companies, chiefly for roadstone and agricultural purposes.

Perry.—Truax-Traer Coal Division of Consolidation Coal Co., Inc., near Pinckneyville and The United Electric Coal Cos. near DuQuoin produced a total of 3.4 million tons of coal from strip mines. Production increased 29 percent over 1961. The entire output was cleaned at company plants. The Burning Star No. 2 plant of Truax-Traer also processed coal mined by the company in Jackson County.

Pope.—Crude fluorspar was mined at three properties by Ozark-Mahoning Co. Output was processed at its plant in Hardin County.

Paving gravel was produced from the Madeker gravel pit by the county highway department. The State and county highway departments contracted for paving gravel.

No coal was produced in 1962; the operations of the Auger Mining Co. were stopped in December 1961.

Pulaski.—Crushed and broken limestone was produced near Ullin by Columbia Quarry Co. from its No. 8 quarry. Output was used for roadstone, railroad ballast, agricultural purposes, and riprap. Clay was produced near Olmsted by Star Enterprises, Inc., for absorbent purposes. Two companies produced a total of 85,000 tons of sand and gravel for paving use.

Randolph.—About 1.9 million tons of coal was produced from 2 strip mines, operated by Ritter Coal Co. and Southwestern Illinois Coal Corp. and from an underground mine operated by Zeigler Coal & Coke Co. The latter two companies operated cleaning plants, using jigs. Total production increased 12 percent over 1961.

Crushed limestone was produced from three underground mines operated near Chester and Prairie du Rocher by Allied Chemical Corp., Chester Quarry Co., and Stotz Quarry Co. Output was for roadstone, agricultural purposes, and chemical uses. Southern Illinois Sand Co. operated a stationary plant near Chester and produced sand for building, paving, and engine use. The State highway department contracted for paving sand.

Rock Island.—Nearly 1.3 million tons of crushed limestone for concrete aggregate and roadstone, agricultural purposes, riprap, and other uses was produced near Milan, Cordova, and Hillsdale by Allied Stone Co., Collinson Stone Co., Cordova Quarry, Inc., and Midway Stone Co., Inc. About 703,000 tons of sand and gravel was produced from portable and stationary plants near Albany, Coal Valley, Cordova, and Milan. Output was for building, paving, fill, and foundry uses.

Plastic fire clay was produced by The Flintkote Co. near Carbon Cliff for refractory use.

St. Clair.—The county ranked fifth in the State in coal production having an output of 4.8 million tons. Nearly 77 percent of the production was from three strip mines, and the remainder was from four underground mines. Strip mines were operated by Morgan Coal Co. near Millstadt and Peabody Coal Co. with mines near Millstadt and Freeburg. Underground mines were operated near Belleville by Belle Valley Coal Co. and Shiloh Valley Coal Co., near Marissa by Midland Electric Coal Corp., and near Millstadt by Peabody Coal Co. The latter company's new underground mine began operating in June. Peabody's River King strip mine was the fifth largest producing bituminous coal mine in the United States in 1962. The Green Diamond mine of Mid-Continent Coal Corp. was acquired by Midland Electric Coal Corp. in June. Virtually the entire county coal output was cleaned at six plants.

About 2.1 million tons of limestone was produced, a decline of 1 percent from 1961 production. Producers included Columbia Quarry Co., East St. Louis Stone Co., Quality Stone Co., Inc., and Casper Stone Quarry & Contracting Co. Operations were near Columbia,

Dupo, East St. Louis, and Hecker. Output was for concrete aggregate, roadstone, agricultural use, riprap, and other purposes.

Missouri-Illinois Material Co. produced sand near East St. Louis for building and road construction, fill, and engine use.

Hydraulic-Press Brick Co. produced clay near East St. Louis for use in manufacturing lightweight aggregate. Hill Brick Co. mined clay near Belleville and used it for manufacturing building brick.

C. K. Williams & Co. produced bleached and unbleached ground barite at its East St. Louis plant for paint filler, rubber filler, and pharmaceutical purposes. The company also produced a wide variety of finished pigments at its plant from iron ore and pyrite cinders produced outside the State.

The American Zinc Co. of Illinois operated zinc smelters at Fairmont City and Monsanto.

Saline.—Coal production was approximately 3.5 million tons, 14 percent more than in 1961. Production was from eight strip mines and from two underground mines. The underground mines were the Nos. 5 and 16 mines of Sahara Coal Co., Inc. Major producers were Sahara Coal Co., Inc., and Saxton Coal Corp. Three cleaning plants, using jigging and pneumatic methods, were operated. Approximately 88 percent of the county production was shipped by rail, and 11 percent was shipped by barge on the Ohio River. The remainder was consumed locally.

Sangamon.—Sand and gravel was produced near Springfield at three stationary plants operated by Buckhart Sand & Gravel Co., Inc., Clear Lake Sand & Gravel Co., and Springfield Sand & Gravel Co. Production of 594,000 tons increased about 3 percent. Output was for building, highway construction, and fill.

Coal production was about 82,000 tons, 5 percent less than in 1961, and came from two underground mines operated near Cantrall by the Cantrall Coal Co. and the Eddy Coal Co. The Cantrall Coal Co. mine, idle during most of 1962, was acquired by Arness Coal Co.

Clay was produced near Springfield by Clay Products Co. for manufacturing heavy clay products and by Poston Brick & Concrete Products Co. for manufacturing building brick and lightweight aggregate.

Tamms Industries Co. produced natural red iron oxide pigments at its Springfield plant from Michigan iron ore.

Schuyler.—Coal production in the county decreased 19 percent to 508,000 tons. Output was from the Key strip mine of Peabody Coal Co. near Rushville. The entire production was cleaned by jigging. Over 92 percent was shipped by barge on the Illinois River; the remainder was shipped by rail and truck. D. & D. Coal Co. had abandoned its underground mine in November 1961.

Elas Quarries operated a portable plant near Rushville and produced 17,000 tons of crushed limestone for roadstone and 26,000 tons of sand and gravel for paving and fill. Sand and gravel was also produced by the Brown County Stone Co. for building, paving, and other purposes.

Scott.—Crushed limestone was produced near Winchester by Krueger Quarry and Thomas Quarry, Inc. Output was for roadstone and agriculture.

Sterling Shafer mined about 17,000 tons of fire clay near Alsey and sold the material for refractory purposes.

Homer E. Grady operated a portable sand and gravel plant near Exeter and produced 4,000 tons of material which was used mostly for fill.

Shelby.—Crushed limestone was produced by Winter's Stone Quarry from the Stewardson quarry near Mode for roadstone and agricultural purposes. Sand and gravel for road construction was produced at a dredging operation of Hanfland Sand & Gravel Co.

Stark.—Coal production from the Allendale strip mine of the Stonefort Coal Mining Co., Inc., near Wyoming increased 29 percent over that of 1961. The entire output of 488,000 tons was cleaned by jigging. All shipments to consumers were by rail.

R. A. Cullinan & Sons, Inc., produced paving gravel near Castleton. The sand and gravel pit of L. Roberts Gravel Co. was abandoned.

Stephenson.—Seven commercial producers and the county highway department produced more than 204,000 tons of limestone from quarries near Freeport, Lena, and Orangeville for roadstone, agricultural purposes, and other uses. In March, Graff Limestone Co. acquired the quarry formerly operated by Fortner Limestone Co. Broege Limestone Co. did not operate its quarry in 1962.

Rockford Sand & Gravel Co. near Freeport and Stich Sand & Gravel Co. near Lena produced sand and gravel. Output was for building, paving, and fill purposes. The sand and gravel operation of Freeport Blacktop Co. was inactive in 1962.

Tazewell.—Over 1.5 million tons of sand and gravel was produced by stationary and portable plants near East Peoria, Mackinaw, and Pekin. Commercial producers were R. A. Cullinan & Sons, Inc., Hoffer Construction Co., Inc., McGrath Sand & Gravel Co., and C. A. Powley Co. Output was used for building and road construction, railroad ballast, fill, and other purposes. The State highway department contracted for paving gravel.

Peoria Brick & Tile Co. produced clay near East Peoria and used the material for manufacturing building brick.

Union.—Nearly 703,000 tons of crushed limestone was produced near Anna by Anna Quarries, Inc., Jonesboro Stone Co., and Midwest Stone Co. Output was used for concrete aggregate, roadstone, asphalt filler, agriculture, and riprap. Lutz Marble Co., Inc., produced dimension limestone for house stone veneer. Bittle Construction Co. produced 3,000 tons of paving gravel.

Vermilion.—Coal was produced near Danville from three underground and two strip mines. Output decreased 3 percent to 1.1 million tons. Strip mines operated by Fairview Collieries Corp. and The United Electric Coal Cos. furnished 96 percent of the output. The remainder came from underground mines operated by Blue Lake Coal Co., Inc., Deep Valley Coal Co., and V-Day Coal Co. Cleaning plants were operated by Fairview Collieries Corp., which used jigs, and by V-Day Coal Co., which used heavy-media and pneumatic methods.

Material Service Division of General Dynamics Corp. quarried limestone near Fairmount for use as concrete aggregate and roadstone. About 138,000 tons of sand and gravel was produced by stationary and portable plants near Alvin, Danville, Hope, Oakwood, and Westville

for building, road construction, and fill. The State highway department contracted for paving gravel.

Clay was produced by the Western Brick Co. near Danville for manufacturing building brick and lightweight aggregate.

Wabash.—Five companies produced a total of 224,000 tons of sand and gravel from stationary and portable plants near Allendale, Belmont, Mt. Carmel, and Grayville. Output was for building, paving, railroad ballast, fill, and other uses.

Approximately 2,600 tons of coal for local consumption was produced by Allendale Coal Co. from a strip mine near Allendale.

Washington.—Pitts Quarry produced over 70,000 tons of crushed limestone near Radom for road construction and agriculture. About 24,000 tons of coal was produced by Venedy Coal Co., Inc., from its underground mine near Venedy. Output was mostly for local consumption.

Will.—About 2.9 million tons of limestone was produced near Joliet and Lockport for roadstone, concrete aggregate, agricultural use, railroad ballast, blast-furnace flux, metallurgical uses, and riprap. Producers were Lincoln Stone Co., Material Service Division of General Dynamics Corp., National Stone Co., and the Illinois State Penitentiary.

Nearly 2.3 million tons of sand and gravel was produced for building, paving, railroad ballast, and fill. Producers were Avery Gravel Co., Chicago Gravel Co., Elmhurst-Chicago Stone Co., Material Service Division of General Dynamics Corp., and C. H. Monk.

Peabody Coal Co. produced 333,000 tons of coal from the Will County portion of its Northern Illinois Strip mine near Wilmington. The mine extends into Grundy and Kankakee Counties. The entire output was cleaned by jigging.

Sulfur was recovered by the Pure Oil Co. from refinery gases at its Lemont refinery. Crude perlite mined in Colorado was expanded by Johns-Manville Perlite Corp. at its Joliet plant. The processed material was sold chiefly for filter use.

Williamson.—The county was first in coal production with an output of 5.8 million tons. Output decreased 3 percent from 1961. Twelve underground mines furnished 65 percent of the total production, and seven strip mines supplied the remainder. Major producers were Bell & Zoller Coal Co., Freeman Coal Mining Corp., Carmac Coal Co., and Stonefort Coal Mining Co., Inc. About 5.6 million tons was cleaned at 12 plants. Jigging, heavy-media, and pneumatic methods were used to process the coal. New Black Diamond Coal Co. abandoned its underground mine near Marion in July. Blue Bell Coal Co. did not operate in 1962. Eleven men were fatally injured in a gas and dust explosion at the Blue Blaze Coal Co. No. 2 mine near Herrin on January 10.

The county highway department produced sand for paving and fill. The State highway department contracted for paving gravel.

Winnebago.—About 1.7 million tons of sand and gravel and 536,000 tons of limestone were produced. Portable and stationary plants were operated near Durand, Pecatonica, Rockford, Rockton, Roscoe, and South Beloit. The State highway department contracted for paving sand and gravel.

The Mineral Industry of Indiana

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey, Indiana Department of Conservation, for collecting information on all minerals except fuels.

By Donald F. Klyce [1] and Mary B. Fox [2]

MINERAL production in Indiana was valued at $202 million, a slight increase over the 1961 value. Increased output of clays, coal, gypsum, sand and gravel, and stone offset a 6-percent drop in cement shipments.

Nonmetals accounted for 53 percent of the value of State mineral production, the same proportion as in 1961. Mineral fuels represented 47 percent of the value, and no metallic minerals were produced.

The Indiana Glass Sand Company, Corydon, was granted a loan by the Federal Area Redevelopment Administration to be used in constructing a plant for processing silica sand from the Ohio River formation. The plant is 12 miles southwest of New Albany. Estimated completion date is mid-September 1963.

TABLE 1.—Mineral production in Indiana [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Abrasives (whetstones)—short tons	5	$14	5	$15
Cement, portland—thousand 376-pound barrels	13,780	47,024	12,878	42,572
Clays—thousand short tons	1,362	2,446	1,450	2,255
Coal (bituminous)—do	15,106	58,815	15,709	60,079
Natural gas—million cubic feet	382	77	284	6
Peat—short tons	57,146	502	51,710	272
Petroleum (crude)—thousand 42-gallon barrels	11,500	34,270	[2] 11,709	[2] 34,893
Sand and gravel—thousand short tons	19,577	16,898	21,261	[3] 8,692
Stone—do	18,001	33,062	18,709	34,653
Value of items that cannot be disclosed: Masonry cement, gem stones, and gypsum	----------	[3] 8,437	----------	8,839
Total	----------	[3] 201,545	----------	202,330

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Preliminary figure.
[3] Revised figure.

[1] Industry economist, Bureau of Mines, Minneapolis, Minn.
[2] Mineral statistician, Geological Survey, Indiana Department of Conservation, Bloomington, Ind.

The Indiana Geological Survey published an annotated bibliography of all significant references on Indiana geology from 1776 to 1955.[3]

Employment and Injuries.—Preliminary data for the mineral industry indicated that nearly 21.8 million man-hours were worked in 1962, excluding officeworkers and employees in the petroleum industry. This represented a decline of over 10 percent from the 1961 final figure of 24.4 million man-hours. The greatest decline was reported by the cement industry. Thirteen fatalities were recorded, compared with 29 in 1961.

Table 2 contains a summary of employment and injury data for selected State mineral industries. Certain industries are excluded from the table, primarily to avoid disclosing individual company confidential data.

TABLE 2.—Employment and injuries for selected mineral industries[1]

Year and industry	Average number of men working	Total man-hours	Total number of disabling injuries		Total number of days lost or charged	Injury frequency rate[2]	Injury severity rate[3]
			Fatal	Non-fatal			
1961:							
Cement[4]	1,284	3,507,485	1	3	(5)	1.14	(5)
Clays[6]	1,492	2,857,332		34	663	11.90	232
Coal (bituminous)	3,318	5,543,626	27	296	182,828	58.27	32,980
Coke Ovens	1,357	3,968,170		19	(5)	4.79	(5)
Limestone[7]	2,516	4,882,888	1	178	(5)	36.66	(5)
Marl	17	16,240					
Sand and gravel	1,074	2,248,183		28	3,016	12.45	1,342
Sandstone	91	127,675		1	(5)	7.83	(5)
1962:[8]							
Cement[4]	1,122	2,695,982	1	8	6,814	3.34	2,527
Clays[6]	1,391	1,585,634		43	1,175	27.12	741
Coal (bituminous)	3,104	5,466,750	6	271	53,909	50.67	9,861
Coke Ovens	1,331	3,874,545	2	6	(5)	2.06	(5)
Limestone[7]	2,361	4,669,289	2	133	19,322	28.91	4,138
Marl	25	18,392					
Sand and gravel	1,093	2,150,300	2	38	13,290	18.60	6,181
Sandstone	98	148,781		5	85	33.61	571

[1] Excludes officeworkers.
[2] Total number of injuries per million man-hours.
[3] Total number of days lost or charged per million man-hours.
[4] Includes cement plants and quarries or pits producing raw material used in manufacturing cement.
[5] Data not available.
[6] Excludes pits producing clay used in manufacturing cement.
[7] Excludes quarries producing limestone used in manufacturing cement.
[8] Preliminary figures.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Materials.—Sandstone was quarried near Orleans, in Orange County, by Hindostan Whetstone Co. of Bedford. Sharpening stones and tapered stones used for cuticle removal were fabricated at a mill near the quarry. This is one of Indiana's oldest mineral operations, and the quarry is said to have been in operation since 1812. Before the era of railroads, the rough stones were hauled by oxcart to a

[3] Nevers, G. M., and Walker, R. D. Annotated Bibliography of Indiana Geology Through 1955. Indian Geol. Survey Bull. 24, 1962, 486 pp.

point below the falls of the White River at Hindostan, where a mill had been built. The finished stones were shipped from there by flatboat to New Orleans and thence to markets all over the world. In the 1820's a mysterious plague struck the village of Hindostan and it was abandoned, but the name "Hindostan Stone" was retained because the product was known by this name over much of the world. Another mill, still in operation, was built at the bottom of the valley near the quarry.

Cement.—Portland and masonry cements were produced at plants operated by Universal Atlas Cement Co. at Buffington in Lake County; Lehigh Portland Cement Co. at Mitchell in Lawrence County; Lone Star Cement Co. at Limedale in Putnam County; and Louisville Cement Co. at Speed in Clark County and at Logansport in Cass County. The Logansport plant began operation in December 1962 and has a capacity of 1.2 million barrels of finished cement. The average mill values of both portland and masonry cements decreased from the 1961 level—portland cement from $3.41 to $3.31 a barrel and masonry cement from $2.75 to $2.66 a barrel.

Shipments of portland cement declined 900,000 barrels, and shipments of masonry cement were larger by 3,600 barrels. Yearend stocks of portland cement at mills were 2 million barrels, the same amount as at the beginning of the year.

Nearly two-thirds of the shipments of portland cement went to ready-mixed-concrete companies, while the remainder was distributed nearly equally among building materials dealers, concrete product manufacturers, and highway and other contractors.

About 42 percent of the cement shipped was used in Indiana. Out-of-State shipments went principally to Illinois, Kentucky, and Wisconsin, and smaller amounts went to 14 other States.

About 2.9 million tons of limestone and over 1 million tons of clay, shale, slag, sand, and gypsum were used in manufacturing cement. Nearly 324 million kilowatt-hours of electrical energy was used at the plants. Three plants manufactured cement by the dry process and two by the wet process. The annual finished-cement capacity of the five plants was over 20 million barrels.

TABLE 3.—Clays sold or used by producers

(Thousand short tons and thousand dollars)

Year	Fire clay		Miscellaneous clay		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	506	$967	1,265	$1,927	1,771	$2,894
1958	315	518	1,056	1,959	1,371	2,477
1959	366	565	1,326	2,350	1,692	2,915
1960	348	635	1,474	2,761	1,822	3,396
1961	334	588	1,028	1,858	1,362	2,446
1962	347	569	1,103	1,686	1,450	2,255

Clay.—Fire clay was mined in seven counties for use in manufacturing heavy clay products, floor and wall tile, refractories, and a few miscellaneous items (pottery, terra cotta, etc.). Fire clay production was slightly larger than in 1961.

Miscellaneous clay was mined in 18 counties, 3 fewer than in 1961. It was used principally in manufacturing heavy clay products, cement, and lightweight aggregates. Output was 75,000 tons greater than in 1961.

Figures compiled by the Indiana Geological Survey indicated that the value of products manufactured from clay and shale was $27.9 million.

Gem Stones.—Small amounts of calcite specimens were found near North Vernon and Morristown, and dolomite was found near Corydon. The value of the gem stones reported was negligible.

Gypsum.—The output of crude gypsum was nearly 20 percent larger than in 1961, reflecting an increased demand from the building industry. Processing plants and mines were operated in Martin County, near Shoals, by National Gypsum Co. and United States Gypsum Co. Plaster, lath, wallboard, and other building materials were manufactured.

Mineral Wool.—Blast-furnace slag from steel mills in Lake County was the principal raw material used to manufacture mineral wool. Small quantities of clay, gravel, and limestone also were used. Plants were located in Huntington, Madison, Wabash, and Wayne Counties.

Perlite.—Crude perlite was expanded at plants in Lake, Martin, and Scott Counties. It was used for building plaster, concrete aggregate, and insulation. The crude material was mined in Colorado, Nevada, and New Mexico.

Sand and Gravel.—The output of sand and gravel was nearly 9 percent larger than in 1961. Most of the gain was due to greater demand for road materials (over 2.4 million tons more than in 1961).

Industrial sands were also in greater demand, and output was nearly 25 percent larger than in 1961. The output of fill material was about the same in both years (3.2 million tons). The only notable decrease was in sand and gravel used for building purposes, where a decline of more than 800,000 tons was reported.

Commercial production was reported in 68 counties at 176 operations. County highway departments in 14 counties produced sand and gravel, mostly for their own use in road programs.

Marion County led in sand and gravel production. Large production was also reported from Allen, Grant, Hamilton, Kosciusko, La Porte, Madison, St. Joseph, Tippecanoe, Vigo, and Wayne Counties.

The 10 leading producers, in alphabetical order, were Allen-Whitley Gravel Co., Inc., Columbia City; American Aggregates Corp., Indianapolis; Interstate Sand & Gravel Co., Inc., Covington; Irving Bros. Gravel Co., Inc., Marion; Irving Materials, Inc., No. 2, Fortville; Manley Sand Division, Martin Marietta Corp., Rockton, Ill.; May Stone & Gravel, Inc., Fort Wayne; S. & L. Gravel Co., Markle; Standard Materials Corp., Indianapolis; and Western Indiana Aggregates Corp., Lafayette.

Slag (Iron-Blast Furnace).—Slag was a byproduct of pig iron production in Lake County blast furnaces. It was crushed for use as an aggregate, expanded for lightweight aggregate, and used in the manufacture of roofing granules, mineral wool, and cement. Roofing granules were made from slag by H. B. Reed & Co., Inc., of Hammond.

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Glass	(1)	(1)	27	$94
Building	4,063	$3,274	3,720	3,020
Paving	2,810	2,252	3,625	2,864
Engine	69	105	(1)	(1)
Fire or furnace	134	237		
Filtration	(1)	(1)	(1)	(1)
Fill	1,191	388	1,331	503
Railroad ballast			8	5
Undistributed [2]	441	687	775	1,150
Total	[3] 8,709	6,943	9,486	[3] 7,635
Gravel:				
Building	3,336	3,685	2,852	3,218
Paving	4,874	4,780	6,435	6,525
Railroad ballast	139	122	134	69
Fill	1,898	958	1,855	956
Other	154	172	76	63
Total	[3] 10,400	9,717	11,352	10,831
Total sand and gravel	19,109	16,660	20,838	18,466
Government-and-contractor operations:				
Sand:				
Building			11	5
Other	1	(4)		
Total	1	(4)	11	5
Gravel:				
Building	35	19		
Paving	323	185	358	203
Fill	110	33	31	9
Other			23	8
Total	[3] 467	[3] 238	412	[3] 221
Total sand and gravel	468	238	423	226
All operations:				
Sand	8,710	6,944	9,497	7,640
Gravel	10,868	9,955	11,764	11,051
Grand total	[3] 19,577	[3] 16,898	21,261	[3] 18,692

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes sand for molding and other uses (1961–62), and blast and foundry (1962).
[3] Data do not add to total shown because of rounding.
[4] Less than $500.

Stone.—Stone production was reported from 57 counties. About 97 percent of the output was crushed for use in cement, concrete aggregate, roadstone, filler, flux, mineral food, and railroad ballast, and for agricultural purposes.

Production of stone was 4 percent greater and 5 percent more valuable than in 1961. Most of the increase was in crushed stone, particularly crushed limestone for concrete aggregate and roadstone. Crushed stone for cement and agricultural purposes registered small declines from the previous year.

Crushed limestone was produced in 45 counties. The largest output came from Allen, Clark, Lawrence, and Putnam Counties. The leading crushed stone producers were Bloomington Crushed Stone Co.,

Inc., The Erie Stone Co., Lone Star Cement Corp., Louisville Cement Co., May Stone & Sand, Inc., Meshberger Stone Corp., Mulzer Brothers, Newton County Stone Co., Inc., Standard Materials Corp., and Western Indiana Aggregates Corp.

TABLE 5.—Limestone sold or used by producers, by uses

Use	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Dimension and building:				
Rough constructions---thousand short tons	1	$15	(1)	(1)
Flagging and rubble---do	113	339	172	$633
Rough architectural (block)---thousand cubic feet	2,820	3,159	2,467	2,695
Dressed (cut or sawed)---do	2,995	7,459	2,986	7,925
Total---approximate thousand short tons [2]	536	10,972	568	11,253
Crushed and broken:				
Riprap---thousand short tons	44	49	120	162
Concrete aggregate, roadstone, etc---do	12,746	16,040	13,416	17,365
Railroad ballast---do	203	253	233	288
Agricultural---do	2,002	2,776	1,972	2,751
Cement---do	2,176	1,531	2,074	1,487
Other [3]---do	205	728	240	691
Total---do	[4] 17,375	21,377	18,055	[4] 22,745
Grand total---do	17,911	32,349	18,623	33,998

[1] Figure withheld to avoid disclosing individual company confidential data; included in totals.
[2] Average weight of 145 pounds per cubic foot used to convert cubic feet to short tons.
[3] Includes limestone for chemicals and whiting, or whiting substitutes (1961), flux, filter beds, stone sand, asphalt filler, fertilizer, and dust for coal mines, mineral food, poultry grit, and other uses.
[4] Data do not add to total shown because of rounding.

TABLE 6.—Calcareous marl production

Year	Number of producers	Short tons	Value	Year	Number of producers	Short tons	Value
1953-57 (average)	6	52,434	$33,244	1960	9	56,406	$38,389
1958	7	60,196	39,637	1961	9	31,707	19,137
1959	8	62,589	39,979	1962	16	50,952	34,657

There was an overall increase in the output and value of dimension stone. Dressed building stone, from the mills of Lawrence and Monroe Counties, was valued at $500,000 more than in 1961, and rough architectural block decreased by about $500,000. The value of flagging and rubble was up by $300,000.

Dimension limestone, quarried and milled principally in Lawrence and Monroe Counties, accounted for about one-third of the value of the stone produced. Leading producers were Bloomington Limestone Corp., Empire Stone Co., B. G. Hoadley Quarries, Inc., Independent Limestone Co., Indiana Limestone Co., Inc., Ingalls Stone Co., Victor Oolitic Stone Co., and Woolery Stone Co., Inc.

Also in the Bloomington-Bedford area were 11 independent finishing mills where purchased stone, mainly rough block, was fabricated into building stone.

Calcareous marl was dug from pits in nine counties. The largest production was reported from Kosciusko County.

Sandstone, principally for building purposes, was quarried in Lawrence, Martin, Monroe, and Spencer Counties. A mill in Orange County processed sandstone from quarries in Lawrence and Martin Counties. A quartz conglomerate was quarried in Martin County and crushed for use in manufacturing refractories.

Sulfur.—Byproduct sulfur was recovered from crude petroleum at the Whiting Refinery of American Oil Co. The Mathieson-Fluor process was used.

MINERAL FUELS

Coal (Bituminous).—Coal production increased 4 percent in quantity, but only 2 percent in value because of a price decrease of 7 cents a ton to $3.82 in 1962. Sixty-nine mines were operated, three fewer than in 1961. Of these, 31 were underground and 38 were strip mines. More than 11.8 million tons of coal was cleaned mechanically at 16 plants. About 11.2 million tons of coal was moved by rail, 1.8 million by water, 1.9 million by truck, and most of the balance by conveyors.

Mining-equipment sales to Indiana coal producers included one mobile loading machine. Sixty-one mobile loading machines and eight continuous-mining machines were in use. More than 98 percent of coal mined underground was loaded mechanically.

About three-fifths of the coal mined was consumed by electric utility companies. Coal was mined in 15 counties, of which 5 (Greene, Pike, Sullivan, Vigo, and Warrick) supplied nearly 85 percent of the total.

Coke.—Coke was produced at 5 plants with 2,218 ovens. Output of 7 million tons was 8 percent smaller than in 1961. Value of the product was $138 million, compared with $133 million in 1961. About 9.7 million tons of coal was delivered to the coke plants, of which more than 90 percent came from Kentucky and West Virginia mines. None was mined in Indiana.

TABLE 7.—Coal (bituminous) production in 1962, by counties

(Excludes mines producing less than 1,000 short tons)

County	Number of mines operated		Production (short tons)			Value
	Underground	Strip	Underground	Strip	Total	
Clay	1	8	1,275	1,188,319	1,189,594	$4,357,860
Daviess		1		44,457	44,457	203,670
Dubois	3		15,133		15,133	60,532
Fountain		1		(1)	(1)	(1)
Gibson	2		549,074		549,074	(1)
Greene	2	6	8,491	1,624,522	1,633,013	6,228,689
Knox	2		123,279		123,279	503,455
Owen		2		(1)	(1)	(1)
Parke		2		(1)	(1)	(1)
Pike	4	3	116,375	1,614,322	1,730,697	6,413,620
Spencer	1	4	7,310	(1)	(1)	(1)
Sullivan	5	1	1,618,334	10,825	1,629,159	6,676,475
Vermillion	3		12,094		12,094	75,705
Vigo	3	1	1,584,022	529,365	2,113,387	8,805,709
Warrick	5	9	364,584	5,805,194	6,169,778	22,265,148
Undistributed				491,927	499,237	4,488,167
Total	31	38	4,399,971	11,308,931	15,708,902	60,079,030

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.

TABLE 8.—Peat production

Year	Number of producers	Short tons	Value	Year	Number of producers	Short tons	Value
1953–57 (average)	7	10,640	$71,693	1960	7	27,486	$290,338
1958	5	12,106	144,974	1961	7	57,146	501,850
1959	5	15,393	202,094	1962	5	51,710	272,238

More than 10.1 million tons of coal was carbonized for coke production, most of which was used in Lake County blast furnaces.

Peat.—Peat (humus, moss, and reed-sedge) was produced from bogs in Benton, Blackford, Grant, Huntington, and Marion Counties. In 1962, five producers reported production, compared with seven in 1961. Output was down 5,436 tons, or 10 percent, and value of shipments declined nearly 40 percent. The peat was sold principally for soil-conditioning and horticultural purposes. None was sold for use as a fuel.

Petroleum and Natural Gas.—During 1962, both the quantity of oil produced and the number of wells drilled increased significantly. Preliminary data indicated that oil production increased substantially over that of 1961. The number of wells drilled increased from 906 in 1961 to 1,525 in 1962. Of these 1,525 wells, 979 were drilled in search of oil or gas, 245 were for secondary-recovery purposes, and 301 were in connection with gas storage projects.

Of the 979 wells drilled in search of oil and gas, 410 were development wells which resulted in 224 oil wells, 8 gas wells, and 178 dry holes. The remaining 569 were exploratory wells, resulting in 16 new-field discoveries, 41 new-pool discoveries, and 20 pool extensions.

Although drilling was carried on in 56 counties, 84 percent of the total was in 9 counties: Posey, 167 wells; Gibson, 165 wells; Spencer, 154 wells; Pike, 125 wells; Dubois, 97 wells; Daviess, 36 wells; Vanderburgh, 32 wells; Knox, 24 wells; and Warrick, 24 wells.

Mississippian rocks proved to be most productive, with 65 successful exploratory wells. Eight wells were completed in Pennsylvanian rocks, two in Devonian rocks, and two in Ordovician rocks.

Almost half of the total oil production was the result of new or expanded waterflooding operations in 45 fields.

Two deep wells, in Gibson and Vanderburgh Counties, were drilled to test Devonian limestone. Neither was successful in the Devonian rocks, but the Gibson County well was productive in upper Mississippian sandstone and the Vanderburgh County well was productive in Pennsylvanian sandstone.

Increased activity in northern Indiana may be expected following successful drilling in De Kalb, Marshall, and Pulaski Counties. A great amount of drilling for underground gas storage sites was carried out in northern Indiana.

At the end of the year, the proved oil reserve was 61,010,000 barrels, and the total liquid hydrocarbon reserve was 61,103,000 barrels.[4]

[4] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association. Proved Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas. V. 17, 1962, 27 pp.

TABLE 9.—Crude petroleum production in 1962, by major fields

Name of field	Year discovered	Area, acres	Location, county	Number of wells		Production, barrels
				Producing	Completed	
Belknap	1947	250	Vanderburgh	20	2	124,185
Black River Consolidated	1950	530	Posey	31	2	110,495
Caborn Consolidated	1940	1,700	do	137	1	281,591
Claypole Hills Consolidated	1944	400	Knox	32	0	195.921
Coe South	1961	260	Pike	16	25	192.611
Evansville	1947	390	Vanderburgh	25	0	101,891
Griffin Consolidated	1938	6,920	Gibson and Posey	672	33	2,585,360
Heusler Consolidated	1938	1,840	Posey and Vanderburgh	121	9	348,280
Inman East	1943	360	Posey	31	0	121,187
Lamott Consolidated	1941	1,330	do	99	1	161,939
Monroe City Consolidated	1950	1,770	Knox	101	1	118,020
Mount Vernon Consolidated	1941	2,060	Posey	176	7	429,662
Mumford Hills	1940	970	Gibson and Posey	71	11	213,983
Owensville Consolidated	1940	1,730	Gibson	141	7	307,430
Owensville North Consolidated	1943	1,890	do	112	4	364,920
Patoka East Consolidated	1947	1,000	do	70	1	140,929
Point	1942	750	Posey	59	18	184,524
Powells Lake Consolidated	1942	460	do	44	2	225,340
Princeton North Consolidated	1943	830	Gibson	64	0	149,540
Springfield Consolidated	1946	2,320	Posey	273	2	1,138,520
Union-Bowman (New) Consolidated.	1941	14,530	Gibson, Knox, and Pike	584	32	891,122
Vienna	1933	320	Vanderburgh	48	0	120.692
Welborn Consolidated	1941	1,610	Posey	141	3	214,454
Wheatonville Consolidated	1949	1,450	Gibson	130	2	133,614
Undistributed				2,750	146	3,343,790
Total				5,948	309	[12,200,000

Source: Petroleum Section, Indiana Geological Survey.

The Indiana Geological Survey published a map showing oil and gas fields in Indiana.[5]

METALS

Aluminum.—Aluminum Company of America operated a smelter in Warrick County and fabricating plants at Fort Wayne, Lafayette, and Richmond. In October, site preparation began for a rolling mill to be built adjacent to the Warrick smelter. The mill will include equipment specifically designed for producing precision-gage sheet required in the container industry and other markets.

Pig Iron and Steel.—Pig iron and steel were produced at East Chicago by Inland Steel Co. and Youngstown Sheet & Tube Co., and at Gary by United States Steel Corp.

Output of pig iron was 8.8 million tons, compared with 8.9 million tons in 1961.

The American Iron and Steel Institute reported that steel production in Indiana was 14 million tons, about the same as in 1961. Nearly 6.3 million tons of coke and coke breeze and 3.4 million tons of limestone and dolomite were used at integrated steel plants.

[5] Dawson, T. A., and Carpenter, G. L. Map Showing Oil and Gas Fields in Indiana. Indiana Geol. Survey, Miscellaneous Map 8, 1962.

REVIEW BY COUNTIES

Mineral production valued at more than $1 million was reported from each of 21 counties, 3 more than in 1961. Petroleum and natural gas were not included in this production.

About 55 percent of the State total came from nine counties: Clark, Lake, Lawrence, Monroe, Pike, Putnam, Sullivan, Vigo, and Warrick. Most of the output of cement, coal, and dimension stone was from these counties. No mineral production was reported from Brown, Ohio, and Union Counties. Petroleum and natural gas production and value are included in the State total, but a breakdown by counties was not available.

As in 1961, about two-thirds of the petroleum was estimated to have come from fields in Gibson and Posey Counties. Some fields covered parts of more than one county, so that actual county production could not be determined.

Adams.—The Krick-Tyndall Co. of Findlay, Ohio, mined clay from a pit near Decatur for use in manufacturing heavy clay products. Meshberger Brothers Stone Corp. operated limestone quarries and crushing plants at Linngrove and Pleasant Mills. Material for agricultural use, concrete aggregate, and roadstone was produced. Lybarger Gravel Co. produced sand and gravel near Geneva for building use.

TABLE 10.—Value of mineral production in Indiana, by counties [1 2]

County	1961	1962	Mineral production in 1962 in order of value [2]
Adams	$495,241	$529,939	Stone, clays, sand and gravel.
Allen	(3)	(3)	Stone, sand and gravel.
Bartholomew	802,900	(3)	Do.
Benton	(3)	(3)	Peat, sand and gravel.
Blackford	(3)	(3)	Stone, peat, clays.
Boone	94,695	117,182	Sand and gravel.
Carroll	(3)	(3)	Stone, sand and gravel.
Cass	511,277	1,208,821	Cement, stone, sand and gravel.
Clark	(3)	(3)	Cement, stone, sand and gravel, clays.
Clay	3,419,546	4,500,904	Coal, clays, stone.
Clinton	32,500	37,132	Sand and gravel.
Crawford	(3)	(3)	Stone.
Daviess	256,682	266,087	Coal, sand and gravel.
Dearborn	156,965	241,248	Sand and gravel.
Decatur	(3)	(3)	Stone.
De Kalb	155,554	378,287	Sand and gravel.
Delaware	948,109	1,039,037	Stone, sand and gravel.
Dubois	154,105	66,011	Coal, clays, sand and gravel.
Elkhart	360,499	435,134	Sand and gravel, stone (marl).
Fayette	(3)	(3)	Sand and gravel.
Floyd	(3)	(3)	Stone, sand and gravel.
Fountain	428,422	493,279	Sand and gravel, clays, coal.
Franklin		(3)	Sand and gravel, clays.
Fulton	37,808	21,658	Sand and gravel, stone (marl).
Gibson	(3)	(3)	Coal, sand and gravel.
Grant	(3)	(3)	Stone, sand and gravel, peat.
Greene	5,487,577	6,399,621	Coal, clays, sand and gravel.
Hamilton	945,823	1,273,944	Stone, sand and gravel.
Hancock	57,320	54,832	Sand and gravel.
Harrison	236,736	233,253	Stone.
Hendricks	(3)	(3)	Sand and gravel.
Henry	(3)	(3)	Do.
Howard	(3)	(3)	Stone.
Huntington	632,825	(3)	Stone, sand and gravel, clays, peat.
Jackson	148,109	139,414	Clays, sand and gravel.
Jasper	(3)	397,457	Stone, sand and gravel.
Jay	112,631	(3)	Do.
Jefferson	(3)	(3)	Stone.
Jennings	161,162	264,188	Do.

See footnotes at end of table.

TABLE 10.—Value of mineral production in Indiana, by counties[1] [2]—Continued

County	1961	1962	Mineral production in 1962 in order of value[2]
Johnson	$296,019	$244,500	Sand and gravel.
Knox	2,760,053	855,340	Coal, sand and gravel.
Kosciusko	439,152	605,208	Sand and gravel, stone (marl).
Lagrange	230,578	81,344	Do.
Lake	(3)	(3)	Cement, clays, sand and gravel.
La Porte	(3)	866,709	Sand and gravel, stone (marl).
Lawrence	10,800,426	11,330,475	Stone, cement.
Madison	1,027,939	1,140,676	Stone, sand and gravel.
Marion	4,079,373	(3)	Sand and gravel, peat.
Marshall	65,530	58,240	Sand and gravel, stone (marl).
Martin	(3)	3,555,392	Gypsum, clays, stone.
Miami	230,294	239,521	Sand and gravel.
Monroe	7,354,948	6,895,791	Stone.
Montgomery	94,715	78,873	Clays, sand and gravel.
Morgan	846,885	507,467	Clays, sand and gravel, stone
Newton	(3)	(3)	Stone, sand and gravel.
Noble	(3)	169,103	Sand and gravel, stone (marl).
Orange	727,032	498,354	Stone, abrasives.
Owen	2,493,217	2,825,753	Coal, stone, clays, sand and gravel.
Parke	388,780	317,601	Sand and gravel, clays, coal.
Perry	(3)	(3)	Stone.
Pike	8,221,998	6,416,810	Coal, stone, sand and gravel.
Porter	262,205	(3)	Sand and gravel, clays.
Posey	72,543	73,372	Sand and gravel.
Pulsaki	(3)	(3)	Stone, clays, sand and gravel.
Putnam	(3)	(3)	Cement, stone, sand and gravel, clays.
Randolph	342,809	322,833	Stone, sand and gravel.
Ripley	285,952	492,479	Stone.
Rush	255,163	(3)	Stone, sand and gravel.
St. Joseph	596,467	757,826	Sand and gravel, stone (marl).
Scott	261,205	182,123	Stone.
Shelby	629,996	754,235	Stone, sand and gravel.
Spencer	(3)	411,967	Coal, stone, sand and gravel.
Starke	40,322	33,696	Sand and gravel.
Steuben	180,401	275,570	Sand and gravel, stone (marl).
Sullivan	7,281,522	6,872,350	Coal, sand and gravel, stone.
Switzerland	123,454	112,696	Stone, sand and gravel.
Tippecanoe	(3)	(3)	Sand and gravel.
Tipton	(3)	(3)	Do.
Vanderburgh	(3)	(3)	Stone, clays.
Vermillion	797,541	744,749	Sand and gravel, clays, coal.
Vigo	8,956,154	9,393,587	Coal, sand and gravel, clays.
Wabash	120,679	(3)	Stone, sand and gravel.
Warren	399,571	388,158	Sand and gravel.
Warrick	19,516,889	22,348,796	Coal, stone, sand and gravel.
Washington	225,810	(3)	Stone, sand and gravel.
Wayne	642,437	835,243	Sand and gravel, stone.
Wells	(3)	(3)	Stone, sand and gravel.
White	336,550	280,750	Stone.
Whitley	422,430	401,370	Sand and gravel.
Undistributed	[4] 104,101,157	102,864,128	
Total	[4] 201,545,000	202,330,000	

[1] Brown, Ohio, and Union Counties did not report production.
[2] Natural gas and petroleum production is not available by counties; included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Revised figure.

Allen.—Limestone was quarried and crushed at Fort Wayne by May Stone & Sand, Inc., and at Woodburn by Midwest Aggregates Corp. In the same areas sand and gravel for building and road use were mined and processed by Paul C. Brudi Stone & Gravel Co. and May Stone & Sand, Inc. The Irving Gravel Co. pit at Harlan was idle during the year. In November 1962, Paul C. Brudi Stone & Gravel Co. opened a second sand and gravel plant in Fort Wayne.

Bartholomew.—Limestone was quarried and crushed near Elizabethtown by Meshberger Stone Corp. Most of the material was used for concrete aggregate and roadstone. Paul Carter operated a sand and

gravel pit near Columbus and produced building materials, fill, and sand for ice control.

Benton.—A bog near Otterbein was mined by Millburn Peat Co., Inc., of Chicago, Ill. The moss peat was sold in bulk and packaged form for soil conditioning and horticultural use. Mt. Gilboa Gravel Co. of Fowler produced road gravel.

Blackford.—Miscellaneous clay was mined near Hartford City by Inman Tile Co. and used in making draintile. Hartford Peat & Gravel Co. produced reed-sedge peat from a bog near Hartford City for bulk sale. J. & K. Stone Co., Muncie, operated a limestone quarry and crushing plant at the Montpelier quarry.

Carroll.—Delphi Limestone Co. operated a quarry and crushing plant near Delphi and produced material for agricultural use, concrete aggregate, and roadstone. Gravel pits near Delphi and Flora yielded fill and road materials.

Cass.—Portland and masonry cements were produced at Logansport by Louisville Cement Co. The new plant began operations in December. Limestone was quarried and crushed in the Logansport area by Cass County Stone Co., Inc., France Stone Co., and Louisville Cement Co. The material was used for cement, flux, concrete aggregate, roadstone, and agricultural purposes. Sand and gravel for building and road use was produced in the county.

Clark.—Louisville Cement Co. produced portland and masonry cements at Speed and mined clay and limestone for use at the plant locally. Limestone was quarried and crushed at Sellersburg by Sellersburg Stone Co. and in the Jeffersonville area by T. J. Atkins Co. and Louisville Sand & Gravel Co. for riprap, road material, and agricultural use. Sand and gravel for building and road use was produced at several sites near Jeffersonville.

Clay.—Coal was produced from seven strip mines and one underground mine. Largest output came from the Ayrshire Collieries Corp. Chinook strip mine. Burwin limestone quarries near Coalmont produced road materials.

Fire clay was mined near Center Point, Ashboro, and Cardonia, and miscellaneous clay was mined in the Brazil area. The material was used in the manufacture of cement, heavy clay products, tile, and pottery.

Crawford.—Hy-Rock Products Co. operated an underground limestone quarry at Marengo. Mulzer Bros. operated the Eckerty quarry. The crushed stone was used for riprap, ballast, road material, and agricultural purposes.

Daviess.—P. & R. Coal Co. operated a strip mine. Mize Gravel Co. produced building and road material near Elnora.

Decatur.—Limestone was quarried and crushed by Harris City Stone Corp. at Greensburg, New Point Stone Co. at New Point, and Kennedy Bros. at St. Omer. The latter quarry was closed in October. The Layton Stone Co. at Westport did not operate in 1962.

Delaware.—Limestone was quarried and crushed in the Muncie area by Irving Bros. Stone & Gravel Co., Muncie Stone & Lime Co., and J. & K. Stone Co. In December the latter company sold its two quarries in Delaware County and one quarry in Blackford County to

Builder's Concrete, Inc., of Muncie. Sand and gravel was produced at several sites in the Muncie area and used mostly for building and paving.

Dubois.—Three underground coal mines operated during the year. The strip mine of Hasenour & Sternberg did not operate in 1962. Hugo H. Bartelt mined fire clay near Huntingburg. It was used for fire brick, pottery, and stoneware. Fill sand was produced near Portersville.

Elkhart.—Marl for agricultural use was dug from pits near Elkhart by E. M. Ulmer & Son. Building and paving materials were obtained from several sand and gravel pits in the Goshen and Elkhart areas.

Floyd.—Limestone was quarried and processed at Greenville by Standard Materials Corp. The material was sold for riprap, concrete aggregate, roadstone, and agricultural use. The city of New Albany produced gravel fill for its own use.

Fountain.—Clay was mined near Veedersburg, Attica, and Riverside and used mostly for making brick. Some was used in the manufacture of inorganic plastics. The Poston-Herron Brick Co., Inc., clay mine at Attica and the Warnick strip coal mine were closed down, during the year. The Maple Grove No. 2 strip coal mine began operations in June. Neal Gravel Co. operated a large sand and gravel plant at Attica and produced building and paving material. Towell & Towell mined road gravel at Kingman.

Franklin.—The Huntersville Brick & Tile Corp. mined clay near Batesville for use in manufacturing heavy clay products. Standard Materials Corp. produced sand and gravel near Metamora. The Franklin County Highway Department produced gravel for its own use.

Fulton.—Marl for soil conditioning was dug from pits near Akron, Macy, and Rochester. In the Rochester area sand and gravel was mined for building use and fill.

Gibson.—Coal was produced from the underground mines of the Princeton Mining Co. (Kings Station mine) and Somerville Coal Co. (Somerville mine). Sand and gravel was mined at several sites in the county. Completion of a new well in northeastern Gibson County resulted in a new-pool discovery in the Harrodsburg limestone in the Union-Bowman Consolidated field, which has been productive for more than 20 years. In 1962, nine new wells were completed in Aux Vases limestone in the Steelman Chapel field, which was discovered in 1961.

Grant.—Limestone was quarried near Sweetser by Pipe Creek Stone Co. Flagstone, as well as crushed material for flux, roadstone, ballast, and agricultural purposes, was produced. Glacier Peat Moss Corp. dug peat from a bog near Jonesboro. Sand and gravel for building and road use was mined in the Marion area.

Greene.—Coal was produced from six strip and two underground mines. The Lambright strip mine was abandoned in 1961. New strip mines that reported production in 1962 were the Blanton and V. J. No. 7. Both fire clay and miscellaneous clay were mined in the county and used for brick and heavy clay products. Sand and gravel was produced near Bloomfield.

Hamilton.—Limestone was quarried and crushed near Noblesville by Stony Creek Stone Co., Inc. Sand and gravel was produced at several sites in the county for building and road use.

Harrison.—Limestone was quarried and crushed near Corydon by Corydon Crushed Stone & Lime Co., Inc., and Mathes Stone Co., and at Depauw by Davis Crushed Stone & Lime Co. It was used mostly for road construction and agricultural purposes.

Howard.—Yeoman Stone Co. at Kokomo produced rubble, as well as crushed limestone for road and agricultural use.

Huntington.—Clay for use in manufacturing draintile was mined near Majenica and Simpson. Humus peat was dug from a bog near Warren. Limestone was quarried and crushed near Huntington by Erie Stone Co. and at Markle by Heller Stone Co., Inc. H. & W. Sand & Gravel Corp. produced sand and gravel from a pit near Andrews.

Jackson.—Clays were mined at Brownstown and Medora for use in making brick and heavy clay products. Lehigh Portland Cement Co. mined shale for its own use. Sand and gravel was produced near Brownstown and Seymour.

Jasper.—W. C. Babcock Construction Co. quarried limestone near Rensselaer for road and agricultural use. Sand and gravel pits in the same area yielded building and road materials.

Jay.—Rockledge Products, Inc., at Portland quarried and crushed limestone for concrete aggregate, roadstone, and agricultural use. Sand and gravel was produced near Pennville.

Jefferson.—Standard Materials Corp. operated the Hanover quarry and produced riprap, agricultural limestone, and material for concrete aggregate and road use.

Jennings.—Berry Materials Corp. operated the North Vernon quarry and produced roadstone and agricultural limestone.

Knox.—Coal was produced from the Enoco and White Ash underground mines. The Shasta Coal Corp. abandoned its strip mine in October 1961. Considerable quantities of building and paving materials were obtained from sand and gravel pits in the Vincennes area.

Kosciusko.—Marl for agricultural use was dug from pits near Atwood, Milford, and Silver Lake. Nearly 800,000 tons of sand and gravel was mined and processed at stationary plants at Leesburg, Syracuse, and Warsaw and at portable plants throughout the county.

Lagrange.—Marl was produced near Howe and Middleburg. Sand and gravel was mined and processed at two sites and sold for building and road use and fill.

Lake.—Portland and masonry cements were produced at Buffington by Universal Atlas Cement Co. Limestone, shipped by water from Michigan quarries, and blast-furnace slag, obtained locally, were the chief raw materials used. National Brick Co. made brick from clay mined near Munster. Industrial sands were mined by John N. Bos Sand Co. at the Dune Park pit near Gary. Sand and gravel for building and road use was produced near Lowell. Federal Cement Products, Inc., Hammond, expanded crude perlite mined in Colorado for use in concrete aggregate. Roofing granules were manufactured from slag by H. B. Reed Co., Hammond. Byproduct sulfur was recovered from crude petroleum at Whiting by American Oil Co. Pig iron and

steel were produced by United States Steel Corp. at Gary and by Inland Steel Co. and Youngstown Sheet & Tube Co. at East Chicago.

La Porte.—Industrial sands were mined at Michigan City by Manley Sand Division of Martin Marietta Corp. Producers Core Sand Corp., which operated in this area, was taken over by the Martin Marietta Corp. J. & A. Gravel Co. produced building and road materials and fill from a pit near La Porte. E. M. Ulmer & Son dug marl from a pit near Walkerton.

Lawrence.—In the Bedford area, Indiana Limestone Co., Inc., and Ingalls Stone Co., Inc., quarried and milled dimension limestone. Several independent stone mills in the area fabricated building stone from rough block purchased from local quarries. Bedford Ground Limestone Co. produced finely ground limestone for use in mineral food, glass manufacture, and agriculture from spalls purchased from stone mills. Limestone for cement, concrete aggregate, roadstone, and agricultural uses was quarried and processed by Bloomington Crushed Stone Co., Inc., at Springville, Mitchell Crushed Stone Co. and Lehigh Portland Cement Co. at Mitchell, and Oolitic Ground Limestone Co. at Bedford. Portland and masonry cements were manufactured at Mitchell by Lehigh Portland Cement Co. Sandstone was quarried and milled for use as building stone by French Lick Sandstone Co., Inc., Indiana Sandstone Co., Inc., Leonard Sandstone Co., Inc., Spice Valley Sandstone Co., Inc., and Springs Valley Sandstone Co.

Madison.—Standard Materials Corp. operated a limestone quarry and mill at Lapel and produced crushed stone for use as riprap, concrete aggregate, roadstone, and agricultural limestone. In the Anderson area more than 500,000 tons of sand and gravel was produced, mostly for building and road use.

Marion.—The largest output of sand and gravel in the State was produced in the Indianapolis metropolitan area. More than 4 million tons was reported, most of it for use in highway construction and building purposes. Packaged and bulk moss peat was produced from a bog near Indianapolis by Peat Moss, Inc.

Marshall.—Marl for agricultural use was produced from a pit near Bremen. Building and road materials were obtained from several sand and gravel pits in the Bremen and Culver areas.

Martin.—Crude gypsum was mined near Shoals by National Gypsum Co. and United States Gypsum Co. Wallboard, plaster, lath, and other building materials were manufactured from the crude ore at plants adjoining the mines. Loogootee Clay Products Co. manufactured building brick from clay mined near Loogootee. General Refractories mined a quartz conglomerate near Shoals for use in making refractories. French Lick Sandstone Co., Inc., operated a sandstone quarry at Trinity Springs. The material was milled at French Lick.

Monroe.—Dimension limestone was quarried and milled by Leo Bennett Stone Co., Bloomington Limestone Corp., Empire Stone Co., B. G. Hoadley Quarries, Inc., Independent Limestone Co., Indiana Limestone Co., Inc., Ingalls Stone Co., Inc., McNeely Quarries, Inc., Midwest Quarries Co., Inc., Victor Oolitic Stone Co., Texas Quarries, Inc., and Woolery Stone Co., Inc. Most of the stone quarried was milled at plants in the Bedford-Bloomington area. Several independent mills fabricated purchased stone. Indiana Calcium Corp. oper-

ated a fine-grinding plant at Bloomington using spalls purchased from local stone mills. Bloomington Crushed Stone Co., Inc., operated a large limestone quarry and crushing plant near Bloomington. Hinkle Sandstone Co. quarried and milled dimension sandstone in the Bloomington area.

Montgomery.—Clay was mined from pits near Crawfordsville by American Vitrified Products Co. and Hydraulic-Press Brick Co. It was used in the manufacture of building brick and vitrified sewer pipe. Gravel for building use was mined from pits near Crawfordsville.

Morgan.—Crushed limestone for road and agricultural use was produced at Gosport by Clayton Winders & Sons. Sand and gravel for building and road use was mined near Martinsville. Clay mined near Brooklyn and Martinsville was used in lightweight aggregate, brick, and sewer pipe.

Newton.—Newton County Stone Co., Inc., Kentland, quarried and crushed limestone for concrete aggregate, railroad ballast, and agricultural use. Sand and gravel was mined near Morocco by Morocco Sand & Gravel Co.

Noble.—Marl was dipped from several pits in the county and sold for agriculture use. Three stationary and several portable sand and gravel plants were in operation throughout the county and produced building and road materials.

Orange.—Hindostan Whetstone Co. operated a quarry and mill near Orleans. Limestone quarries and crushing plants were operated at French Lick, Orleans, and Paoli. At French Lick dimension sandstone was milled from material quarried in Lawrence and Martin Counties by French Lick Sandstone Co.

Owen.—Coal was produced from two strip mines by Burcham Bros., Inc., and Peabody Coal Co. Fire clay was mined from the Old Glory coal mine by Peabody Coal Co. and sold to manufacturers of heavy clay products, architectural terra cotta, and floor and wall tile. Dimension limestone was quarried at Romona by Ingalls Stone Co. and milled at Bedford. At Spencer limestone was quarried and crushed for riprap, flux, roadstone, ballast, and agricultural use. Sand and gravel for building and road use was mined at two sites.

Parke.—Coal was mined from the Maple Grove and Turner strip mines. The latter mine also produced fire clay that was sold for making brick. The Cayuga Brick & Tile Co. clay pit was idle during the year. Sand and gravel was produced for road building and fill.

Perry.—Mulzer Bros. operated the Derby limestone quarry and mill and produced riprap, roadstone, and agricultural limestone. The U.S. Brick Co. plant at Tell City was struck by lightning in August 1961 and severely damaged. Operations have not been resumed.

Pike.—Three strip and four underground mines produced coal. The Davis Excavating Co. strip mine was not operated in 1962. The Enos and Blackfoot mines of the Enos Coal Co. reported the largest production. The Pike County Highway Department quarried riprap for its own use.

Porter.—Charles Lorenz & Son mined fire clay from the Lenburg pit near Portage and the Schrock pit near Chesterton. It was sold to manufacturers of pottery and refractories. Crisman Sand Co., Inc., mined blast sand near Portage.

Posey.—Half of the major oil fields in the State were located wholly or partially in Posey County. As in 1961, the county led in the number of new wells drilled. Sand and gravel was produced near Mount Vernon and New Harmony.

Pulaski.—Francesville Drain Tile Corp. mined clay for its own use near Francesville. Limestone was quarried and crushed by Western Indiana Aggregates Corp. for riprap, roadstone, and agricultural use. Sand and gravel was produced near Star City.

Putnam.—Portland and masonry cements were manufactured at Limedale by Lone Star Cement Corp. The company quarried limestone for its own use. The Indiana State Farm, at Putnamville, mined clay and quarried limestone for use by State agencies. Limestone was also quarried and crushed by Ohio & Indiana Stone Corp. at Greencastle, by Russellville Stone Co. (Div. of Gorham Const. Co., Inc.) at Russellville, and by Standard Materials Corp. at Manhattan and Stilesville. The Midway Stone Co., Inc., quarry was sold and operations were discontinued. Sand and gravel was mined at Reelsville.

Randolph.—Limestone was quarried and crushed at Albany by Portland Stone Co. and at Ridgeville by H. & R. Stone Co. Sand and gravel was produced with stationary plants at Farmland and Lynn and at several sites by the county highway department's portable plant.

Ripley.—Limestone quarries were operated near Versailles by Berry Materials Corp. and Cord Stone Co., at Napoleon by New Point Stone Co., and at Osgood by South Eastern Materials Corp. The stone was crushed and used for riprap, concrete aggregate, roadstone, and agricultural limestone.

Rush.—Limestone was quarried and crushed at Milroy by McCorkle Stone Co. and Rush County Stone Co. Gravel for road use and fill was produced at several sites with portable plants.

St. Joseph.—Marl was dipped from pits near North Liberty and South Bend and sold for soil conditioning. Nearly 800,000 tons of sand and gravel was produced in the South Bend area, principally for building and road construction.

Scott.—The Scott County Stone Co. at Scottsburg quarried and crushed limestone for road and agricultural use. Airlite Processing Corp., Vienna, expanded crude perlite mined in Western States. The material was used for insulation, plaster, and concrete aggregate.

Shelby.—The Blue Ridge Quarries, Waldron, produced limestone for flagging and rubble. Limestone quarries and crushing plants at Flat Rock, St. Paul, and Waldron produced riprap, roadstone, ballast, fluxstone, and agricultural limestone. Sand and gravel was produced at Shelbyville for building and road use and fill.

Spencer.—Coal was produced from four strip mines and one underground mine. The Graham strip mine began production during the year near Chrisney. Sandstone was quarried and milled at St. Meinrad by St. Meinrad's Quarry Industries. Building stone and flagging was produced. Hardy Sand Co. mined molding sand at Sandale.

Steuben.—Marl, for agricultural use, was dipped from a pit near Hudson. Sand and gravel was produced at stationary plants at Angola and Fremont and at several sites by the county highway department's portable plant.

Sullivan.—Coal was produced from one strip mine and five underground mines. The Hoosier Gem strip mine was abandoned in 1961. Kixmiller Bros. produced agricultural limestone at Freelandsville. Sand and gravel for building and road use and fill was produced at several sites.

Switzerland.—Tri-County Stone Co. at Cross Plains produced limestone for concrete aggregate, roadstone, agricultural use, and asphalt filler. The county highway department produced gravel for its own use.

Vanderburgh.—Mulzer Bros. produced roastone and agricultural limestone from the West Franklin quarry. Late in the year the company purchased a major share of the assets of Bedford-Nugent Sand & Gravel Co. Standard Brick & Tile Corp., Evansville, mined clay for its own use.

Vermillion.—Coal was produced from three underground mines. The Kanizer strip mine of Love Brothers Coal Co. did not report production. Fire clay was mined at the Dana pit, north of Hillsdale, and used for glazed structural tile. Miscellaneous clay, mined at Cayuga, was used for brick. Large sand and gravel plants were operated at Cayuga by Material Service Division of General Dynamics Corp. and at Clinton by Standard Materials Corp.

Vigo.—Coal was produced from one strip mine and three underground mines. The Tri-K mine discontinued operations in December 1961. In West Terre Haute, the Terre Haute Vitrified Brick Works, Inc., mined clay for its own use. Sand and gravel was produced at several sites in the Terre Haute area.

Wabash.—Mill Creek Stone Co. produced limestone at Wabash for concrete aggregate, roadstone, and agricultural use. Sand and gravel was produced at three stationary plants and sold for fill and building and paving purposes.

Warrick.—Coal was produced from nine strip mines and five underground mines. The B. & B. Coal Co. strip mine was closed in October 1961 and did not reopen in 1962. Roadstone was produced by the Tecumseh Coal Corp. near Boonville. The Lemmon & Co., Inc., quarry did not operate. Sand and gravel was produced near Boonville.

Washington.—Hoosier Lime & Stone Co. quarried and crushed limestone near Salem for concrete aggregate and road and agricultural use. The county highway department produced road gravel for its own use.

Wayne.—At Richmond the DeBolt Concrete Co., Inc., quarried limestone for riprap and road and agricultural use. Nearly 600,000 tons of sand and gravel was produced at several sites throughout the county. Much of the material was used for highway maintenance and construction.

Wells.—The Erie Stone Co. operated a limestone quarry and processing plant near Bluffton and produced material for blast-furnace flux, concrete aggregate, roadstone, and agricultural limestone. Sand for railroad ballast and fill was mined near Bluffton.

White.—Monon Crushed Stone Co., Inc., quarried and crushed limestone near Monon for agricultural use, road materials, and railroad ballast.

The Mineral Industry of Iowa

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Iowa for collecting information on all minerals except fuels.

By John W. Sweeney [1]

MINERAL production in Iowa was valued at $96.6 million, compared with the revised total of $95 million in 1961, setting a record high for mineral production in the State. Rising demand for sand and gravel, along with higher unit values for sand and gravel and clays, more than offset the small declines in stone. The downward trend in coal production was reversed showing a substantial gain. Sales of cement and gypsum showed a slight increase over 1961.

Principal commercial minerals are limestone, sand and gravel, gypsum, coal, clays, and peat. Exploration was conducted in Clayton County for lead-zinc deposits and low-grade iron ore, but no production of metallic minerals was reported.

TABLE 1.—Mineral production in Iowa [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland ---- thousand 376-pound barrels	12,108	$41,718	12,261	$42,417
Masonry ---- thousand 280-pound barrels	557	1,843	568	1,786
Clays ---- thousand short tons	1,044	1,426	1,039	1,427
Coal (bituminous) ---- do	927	3,323	1,130	4,026
Gypsum ---- do	1,239	5,276	1,256	5,318
Sand and gravel ---- do	13,391	11,651	13,797	12,474
Stone ---- do	22,018	28,916	21,618	28,244
Value of items that cannot be disclosed: Other nonmetals		845		869
Total		[2] 94,998		96,561

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Revised figure.

[1] Geologist, Bureau of Mines, Minneapolis, Minn.

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Employment and Injuries.—Preliminary data show that approximately 9.6 million man-hours were worked in Iowa mineral industries in 1962, excluding officeworkers. This represented a 2-percent decrease from the 9.8 million man-hours for 1961.

Four fatalities, two at limestone operations, one at a sand and gravel plant and one at a limekiln, occurred in 1962 compared with none in 1961. The total number of nonfatal disabling injuries decreased from 169 in 1961 to 151.

Table 2 contains a summary of employment and injury data for selected State mineral industries. Certain industries are excluded from the table, primarily to avoid disclosing individual company confidential data.

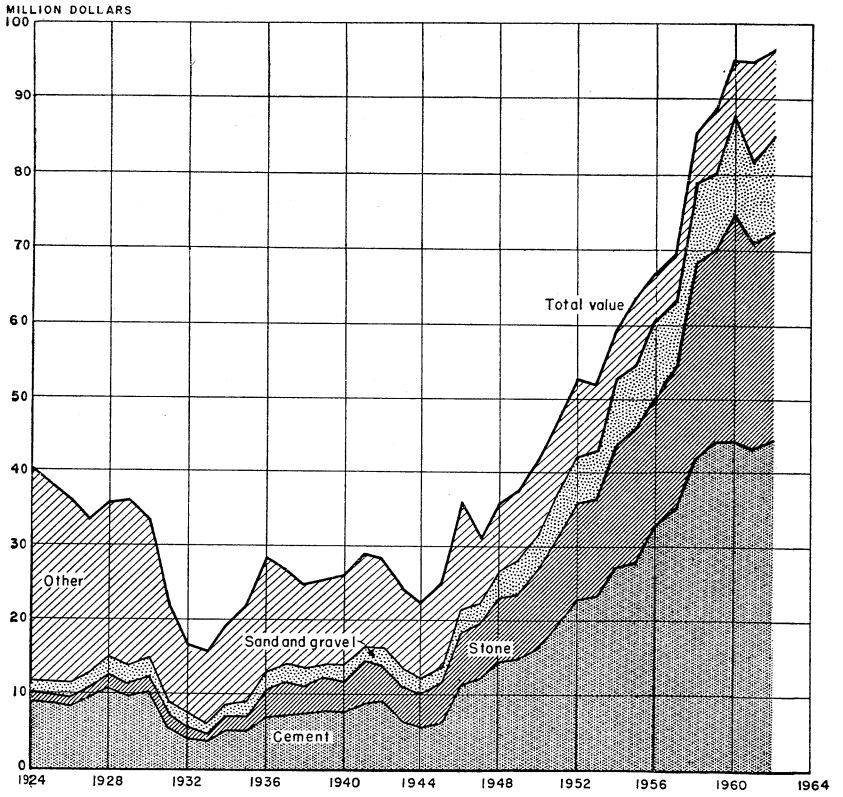

FIGURE 1.—Value of cement, stone, sand and gravel, and total value of mineral production in Iowa, 1924–62.

TABLE 2.—Employment and injuries for selected mineral industries [1]

Year and industry	Average number of men working	Total man-hours	Total number of disabling injuries		Total number of days lost or charged	Injury frequency rate [2]	Injury severity rate [3]
			Fatal	Nonfatal			
1961:							
Cement [4]	1,097	2,630,579	----	5	(5)	1.90	(5)
Clays [6]	399	812,806	----	26	387	31.99	476
Coal (bituminous)	423	617,622	----	21	1,492	34.00	2,416
Gypsum	204	473,224	----	1	116	2.11	245
Limestone [7]	1,338	2,893,048	----	81	(5)	28.00	(5)
Sand and gravel	1,191	2,236,781	----	34	628	15.20	281
1962: [8]							
Cement [4]	979	2,379,648	----	6	270	2.52	113
Clays [6]	754	1,455,559	----	52	1,226	35.73	842
Coal (bituminous)	413	634,185	----	16	978	25.23	1,542
Gypsum	206	429,437	----	----	----	----	----
Limestone [7]	1,398	2,861,099	2	57	18,014	20.62	6,296
Sand and gravel	1,084	1,728,029	1	18	6,249	11.00	3,616

[1] Excludes officeworkers.
[2] Total number of injuries per million man-hours.
[3] Total number of days lost or charged per million man-hours.
[4] Includes cement plants and quarries or pits producing raw material used in manufacturing cement.
[5] Data not available.
[6] Excludes pits producing clay used in manufacturing cement.
[7] Excludes quarries producing limestone used in manufacturing cement and lime.
[8] Preliminary figures.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Portland cement production increased 1 percent over 1961, and sales increased 2 percent. The average unit value per barrel, f.o.b. mill, was $3.46, compared with $3.45 in 1961. There was no change in the number of cement plants operating. Lehigh Portland Cement Co., and Northwestern States Portland Cement Co. operated in Cerro Gordo County; Marquette Cement Manufacturing Co. and Penn-Dixie Cement Corp. operated in Polk County; and Dewey Portland Cement Co., in Scott County. Total capacity of these plants remained more than 15 million barrels per year.

A total of 28 kilns were operated by the companies. Two companies used a dry process, and three used a wet process. Raw materials used in manufacturing cement were limestone and clay or shale from local sources; gypsum, purchased chiefly from producers operating in Webster County; and purchased iron ore or mill scale. A total of 271 million kilowatt hours of electrical energy was consumed with about two-thirds being purchased and one-third home generated.

Types I and II, general-use and moderate-heat cements, and type III, high-early strength cement, were produced at all five plants. Major markets for cement were in Iowa and Minnesota, followed by Illinois, Wisconsin, Nebraska, North Dakota, South Dakota, and Missouri. The cement was shipped by railroad and truck, mostly in bulk; no movement by boat was reported. Sales as reported by producers were: 1.7 million barrels of portland cement to building material dealers, 2.0 million barrels to concrete product manufacturers, 6.5 million barrels to ready-mixed concrete companies, 1.8 million barrels to highway contractors, and 0.2 million barrels to other sources.

Mixed hydraulic and masonry cements were produced at four of the five plants. Production increased 2 percent, and sales decreased 3 percent. The average price per 280-pound barrel was $3.15, compared with $3.31 in 1961, a 5-percent decrease in value per barrel. The marketing area was similar to that for portland cement.

Clays.—Deposits of clay and shale were mined for use chiefly in manufacturing heavy clay products, such as building brick, building tile, and draintile. Other major uses were for cement, lightweight aggregate, and mortar mix. Fire clay was used in manufacturing refractories. Lightweight aggregate was produced by the Carter-Waters Corp. of Kansas City, Mo. Expandable shale was mined from their pit near Centerville, Appanoose County. Sales of crude clay were reported by only 4 of the 25 companies reporting production. The other companies used their entire output in their own plants. The companies selling crude clay or shale were Nelson Clay Products Co. in Keokuk County, Ver Steeg Coal Co. in Marion County, Goodwin Tile and Brick Co. in Polk County, and Vincent Clay Products Co. in Webster County. Clay produced by Nelson Clay Products Co. and Ver Steeg Coal Co. was classed as fire clay. Of the total shale or clay produced, 45 percent was used in manufacturing cement, and 45 percent was used in heavy clay products. The remainder was used chiefly in lightweight aggregate, mortar, and masonry cement.

Shale or clay pits were operated by 26 firms in 17 counties. The What Cheer Clay Products Co. facilities in Mahaska County were sold early in 1962 to Griffin Pipe Products Co. Ver Steeg Coal Co. started production of clay in Marion County.

Most of the clay products were used in the State; however, some brick, tile, and lightweight aggregates were sold in neighboring States.

Gypsum.—Quantity and value of crude gypsum was 1 percent more than 1961, paralleling the slight upturn in overall building construction. Gypsum was mined and processed by United States Gypsum Co., in Des Moines and Webster Counties and Bestwall Gypsum Co., The Celotex Corp., and National Gypsum Co. in Webster County.

A wide variety of gypsum products was produced, including gypsum lath, wallboard, sheathing, tile, base-coat plasters, ready-mixed and other special-use plasters, and pulverized gypsum. The major markets for consumption were in construction, cement manufacture, agriculture, and as a filler. Other markets were the glass and pottery industry and concerns having miscellaneous molding requirements. The estimated unit value of crude gypsum was $4.23 per ton, compared with $4.26 per ton in 1961.

Lime.—Linwood Stone Products Co., Inc., was the only commercial producer of quicklime and hydrated lime. American Crystal Sugar Co. produced quicklime for internal use in sugar refining. Sales of quicklime decreased slightly while sales of hydrated lime increased.

Linwood Stone Products Co., Inc., mined a high calcium limestone from a pit near Buffalo, Scott County. High calcium limestone was also used by American Crystal Sugar Co., Mason City, Cerro Gordo County. Major uses were for water purification, steel (open-hearth furnaces), sugar refining, sewage treatment, and in manufacturing sand-lime brick. The major market area was Iowa and Illinois, minor quantities being sold in other adjacent States.

Linwood Stone Products Co., Inc., used a rotary kiln and a continuous hydrator. American Crystal Sugar Co. used a shaft kiln. Fuels used were natural gas, bituminous coal, and coke.

Perlite.—Each of the gypsum producers in the State expanded perlite, which was used for lightweight plaster aggregate. Crude perlite was purchased from producers in Colorado and New Mexico. The chief market area was Iowa and adjacent States.

Sand and Gravel.—Production of sand and gravel increased 3 percent in quantity and 7 percent in total value over 1961. Commercial sales of sand and gravel for building use declined slightly as home construction decreased slightly. However, commercial sales of sand and gravel for paving increased, paralleling the increase in highway construction in some areas. Production of sand and gravel by Government-and-contractor producers was less in 1962. Overall average unit values for sand and gravel increased a few cents, although a decline in average unit value was noted for some of the minor uses.

Production of industrial sand increased over 1961, but average unit values declined slightly. Uses included molding sand, blast sand, engine sand, and filter sand. As in 1961, most of the molding sand was produced from a friable sandstone deposit in Clayton County.

About 8 percent of the commercial sand and gravel production was sold as unprocessed material. Commercially produced sand and gravel was transported chiefly by truck.

The 10 leading producers, several operating in two or more areas of the State, in alphabetical order were:

Acme Fuel & Material Co.
Concrete Materials Division, Martin Marietta Corp.
L. G. Everist, Inc.
Hallett Construction Co.
Kaser Construction Co.
Maudlin Construction Co.
Mauer Construction Co.
Pound Construction Co., Inc.
Van Dusseldorp Construction Co.
Welp & McCarten, Inc.

Stone.—Limestone was the leading raw mineral commodity, production being reported from 66 of 99 counties.

Overall production of stone was about 2 percent lower in quantity and value. Most of the decrease was in crushed limestone. This decrease was attributed to a very wet spring, which delayed mining activities, and a lack of construction and highway programs in some areas of the State.

Dimension limestone production was less than 1 percent of the total stone production. Quarries were operated in Dubuque, Jones, and Delaware Counties. Production of sawed stone, house stone veneer, cut stone, flagging, and rubble was reported by Becker Stone Quarry near Dubuque and William C. Weber Stone Co., near Anamosa.

Concrete aggregate and roadstone accounted for about 77 percent of the total limestone output. Cement manufacturers used 15 percent of the total, and agricultural limestone consumption accounted for 5 percent. All other uses accounted for the remaining 3 percent.

TABLE 3.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,560	$2,178	2,340	$2,095
Paving [1]	1,379	1,160	1,524	1,310
Fill	475	241	461	249
Undistributed [2]	171	522	231	596
Total	4,585	4,101	4,556	4,250
Gravel:				
Building	1,521	2,300	1,556	2,335
Paving [1]	3,842	3,034	4,618	4,033
Fill	111	64	209	126
Undistributed [3]	95	166	169	288
Total	5,569	5,564	[4] 6,551	[4] 6,783
Total sand and gravel	10,154	9,665	[4] 11,108	11,033
Government-and-contractor operations:				
Sand:				
Building	1	(5)		
Paving	49	27	39	21
Fill	12	9	9	5
Other	3	2	13	6
Total	65	38	61	[4] 31
Gravel:				
Paving	3,157	1,942	2,555	1,383
Fill			2	1
Other	15	6	71	27
Total	3,172	1,948	[4] 2,629	[4] 1,410
Total sand and gravel	3,237	1,986	2,690	1,441
All operations:				
Sand	4,650	4,139	4,617	4,281
Gravel	8,741	7,512	9,180	8,193
Grand total	13,391	11,651	13,797	12,474

[1] Includes materials for bridges, culverts, and other uses.
[2] Includes railroad ballast, other uses, molding, blast, engine, filter, and other industrial uses.
[3] Includes gravel for railroad ballast and other uses.
[4] Data do not add to totals shown because of rounding.
[5] Less than $500.

Average unit values increased a few cents for all uses except for concrete aggregate and roadstone, which was $1.28 per ton in 1962 and $1.31 per ton in 1961. Overall unit value of crushed stone for all uses remained unchanged at $1.31 per ton.

The five leading limestone producing counties listed by production were Scott, Madison, Linn, Cerro Gordo, and Hardin.

The 10 leading producers of limestone, listed alphabetically, were:

B. L. Anderson, Inc.
Concrete Materials Division, Martin Marietta Corp.
Dewey Portland Cement Co.
Kaser Construction Co.
Lehigh Portland Cement Co.
Missouri Valley Limestone Co., Inc.
Northwestern State Portland Cement Co.
E. I. Sargent Quarries, Inc.
Schildberg Construction Co., Inc.
Weaver Construction Co.

TABLE 4.—Limestone sold and used by producers, by uses

Use	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Dimension:				
Rough construction (1961) and rubble, thousand short tons	4	$28	4	$33
Sawed, thousand cubic feet	4	14	4	12
House stone veneer, do.	9	28	7	23
Cut, do.	58	77	42	69
Flagging, do.	4	4	2	3
Total, approximate thousand short tons [1]	10	151	9	[2] 139
Crushed and broken:				
Riprap, thousand short tons	300	405	378	535
Concrete aggregate and roadstone, do.	16,996	22,215	16,618	21,321
Agriculture, do.	1,102	1,483	1,135	1,582
Railroad ballast, do.	[3]	[3]	25	32
Cement, do.	3,417	3,691	3,138	3,601
Undistributed [4], do.	193	971	315	1,034
Total, do.	22,008	28,765	21,609	28,105
Grand total, do.	22,018	28,916	21,618	28,244

[1] Average weight of 170 pounds per cubic foot used to convert cubic feet to short tons.
[2] Data do not add to total shown because of rounding.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Includes limestone for railroad ballast and dust for coal mines (1961), filter beds (1962), asphalt filler, fertilizer, fluxing, mineral food, lime, and other uses.

MINERAL FUELS

Coal (Bituminous).—Production and value of coal increased about 21 percent. The declining trend in coal mining in Iowa was reversed and showed substantial gains. Additional power facilities constructed in the State and a severe winter contributed to the additional use of coal over 1961. Most of the coal produced was consumed in electric powerplants and in heating public buildings. Virtually all Iowa coal was consumed within the State. About two-thirds of the coal was hauled to destinations by rail and one-third by truck. Mines in Marion County accounted for 57 percent of the total State output. The average price per ton of coal was $3.56, compared with $3.58 in 1961.

Production came from 13 underground mines and 22 strip mines, compared with 14 underground mines and 26 strip mines in 1961. The thickness of the coal seams mined in the strip mines ranged from 36 to 60 inches, and overburden ranged from 20 to 75 feet. In underground mining, the coal seams ranged from 29 to 84 inches.

No mechanical cleaning plants were operated in the State.

Peat.—Two companies, Colby Pioneer Peat Co. and Eli Colby Co., produced peat in Worth and Winnebago Counties. Moss, reed-sedge, and humus were produced. Both companies had processing plants in Hanlontown.

TABLE 5.—Coal (bituminous) production in 1962, by counties

(Excludes mines producing less than 1,000 tons)

County	Number of mines operated		Production (short tons)			Value
	Underground	Strip	Underground	Strip	Total	
Appanoose	8		48,474		48,474	$264,603
Lucas	1	1	38,702	1,124	39,826	179,670
Mahaska		7		285,029	285,029	966,245
Marion	3	9	64,238	580,210	644,448	2,189,687
Monroe	1	2	12,268	23,982	36,250	114,667
Van Buren		1		18,433	18,433	95,609
Wapello		2		57,104	57,104	215,200
Total	13	22	163,682	965,882	1,129,564	4,025,681

REVIEW BY COUNTIES

Mineral production was reported from all counties except Audubon, Ida, Ringgold, and Wayne. Some sand and gravel or limestone may have been produced in these counties, as several companies reporting production of these materials did not submit a breakdown showing output by county of origin. Estimates were made for nonreporting companies producing these commodities. The estimates were based on previous reports and other sources of information, notably reports submitted by State, county, and municipal highway departments.

Some counties are not included in the county review section. However, all producing counties, as well as the minerals produced, are listed in table 6.

Adair.—Schildberg Construction Co., Inc., produced limestone from one stationary plant and two portable plants near Greenfield. Production was mainly used for highway construction and agricultural uses.

Adams.—Limestone was produced by two companies, Missouri Valley Limestone Co., Inc., and Schildberg Construction Co., Inc., for riprap, highway construction, and agricultural use.

TABLE 6.—Value of mineral production in Iowa, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value
Adair	(2)	(2)	Stone.
Adams	(2)	(2)	Do.
Allamakee	$42,138	(2)	Stone, sand and gravel.
Appanoose	908,280	$958,242	Stone, coal, clays, sand and gravel.
Benton	(2)	(2)	Sand and gravel, stone, clays.
Black Hawk	453,706	1,219,599	Stone, sand and gravel.
Boone	(2)	(2)	Sand and gravel, clays.
Bremer	5,560	3,610	Sand and gravel, stone.
Buchanan	132,699	(2)	Stone, sand and gravel.
Buena Vista	231,906	197,328	Sand and gravel.
Butler	232,140	346,879	Stone, sand and gravel.
Calhoun	28,644	87,667	Sand and gravel.
Carroll	165,617	188,688	Do.
Cass	(2)	(2)	Stone, sand and gravel.
Cedar	(2)	271,229	Do.
Cerro Gordo	24,765,105	24,582,656	Cement, stone, clays, lime, sand and gravel.
Cherokee	456,274	257,817	Sand and gravel.
Chickasaw	(2)	(2)	Stone.
Clarke	(2)	(2)	Do.
Clay	168,368	154,152	Sand and gravel.
Clayton	(2)	528,111	Sand and gravel, stone.

See footnotes at end of table.

TABLE 6.—Value of mineral production in Iowa, by counties[1]—Continued

County	1961	1962	Minerals produced in 1962 in order of value
Clinton	(2)	(2)	Stone, sand and gravel.
Crawford	$83,465	(2)	Sand and gravel.
Dallas	355,726	$319,893	Sand and gravel, clays, stone.
Davis		(2)	Sand and gravel.
Decatur	(2)	(2)	Stone, sand and gravel.
Delaware	339,251	248,067	Do.
Des Moines	863,153	1,271,548	Gypsum, stone, sand and gravel.
Dickinson	50,323	(2)	Sand and gravel.
Dubuque	470,100	458,365	Stone, sand and gravel.
Emmet	165,437	154,651	Sand and gravel.
Fayette	294,303	548,104	Stone, sand and gravel.
Floyd	379,107	332,666	Stone, clays, sand and gravel.
Franklin	381,382	287,126	Sand and gravel, stone, clays.
Fremont	60,732	63,551	Stone.
Greene	(2)	(2)	Sand and gravel.
Grundy	(2)	89,550	Sand and gravel, stone.
Guthrie	(2)	(2)	Sand and gravel.
Hamilton	93,018	161,292	Stone, sand and gravel.
Hancock	318,721	283,555	Sand and gravel, stone.
Hardin	1,480,450	1,261,951	Stone, sand and gravel.
Harrison	(2)	(2)	Do.
Henry	(2)	(2)	Do.
Howard	141,089	(2)	Do.
Humboldt	243,622	(2)	Do.
Iowa	(2)	(2)	Sand and gravel.
Jackson	131,132	159,360	Stone, sand and grave
Jasper	(2)	(2)	Do.
Jefferson		(2)	Stone.
Johnson	734,956	734,296	Stone, sand and gravel.
Jones	306,540	349,234	Do.
Keokuk	(2)	(2)	Stone, clays.
Kossuth	(2)	223,655	Sand and gravel.
Lee	382,454	(2)	Stone.
Linn	1,571,112	2,051,158	Stone, sand and gravel.
Louisa	(2)	(2)	Do.
Lucas	(2)	179,670	Coal.
Lyon	129,040	175,650	Sand and gravel.
Madison	2,405,499	3,032,294	Stone, clays.
Mahaska	1,035,118	1,584,914	Coal, sand and gravel, stone, clays.
Marion	2,324,542	2,841,808	Coal, stone, sand and gravel, clays.
Marshall	(2)	(2)	Sand and gravel, stone.
Mills	(2)	225,155	Stone.
Mitchell	419,608	349,511	Stone, sand and gravel.
Monona		72,000	Sand and gravel.
Monroe	141,209	180,373	Coal, stone.
Montgomery	(2)	(2)	Stone.
Muscatine	1,088,391	1,043,768	Sand and gravel, stone.
O'Brien	160,186	152,193	Sand and gravel.
Osceola	96,349	(2)	Do.
Page		(2)	Stone.
Palo Alto	(2)	64,381	Sand and gravel.
Plymouth	(2)	(2)	Do.
Pocahontas	(2)	557,453	Stone, sand and gravel.
Polk	12,584,488	13,008,307	Cement, sand and gravel, clays.
Pottawattamie	(2)	(2)	Stone.
Poweshiek	(2)	(2)	Stone, sand and gravel.
Sac	(2)	460,105	Sand and gravel.
Scott	12,122,061	12,892,016	Cement, stone, lime, clays, sand and gravel.
Shelby		(2)	Sand and gravel.
Sioux	616,864	837,131	Do.
Story	685,763	618,392	Stone, sand and gravel, clays.
Tama	(2)	(2)	Stone, sand and gravel.
Taylor	(2)	(2)	Stone.
Union	(2)	(2)	Do.
Van Buren	859,512	1,027,527	Stone, sand and gravel, coal.
Wapello	454,504	643,792	Stone, coal, sand and gravel, clays.
Warren	(2)	87,500	Sand and gravel, clays.
Washington	(2)	(2)	Stone.
Webster	5,425,286	5,247,338	Gypsum, stone, sand and gravel, clays.
Winnebago	(2)	(2)	Sand and gravel, peat.
Winneshiek	(2)	(2)	Sand and gravel, stone.
Woodbury	95,380	(2)	Sand and gravel.
Worth	504,564	(2)	Peat, sand and gravel, stone.
Wright	165,490	132,205	Sand and gravel.
Undistributed	17,247,905	13,352,831	
Total	[3] 94,998,000	96,561,000	

[1] The following counties are not listed because no production was reported: Audubon, Ida, Ringgold, and Wayne.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.

Allamakee.—Limestone was produced by three companies and sand and gravel by two companies. The sand and gravel was mainly used for building and road construction; the limestone, for roadstone and agricultural use.

Appanoose.—The Carter-Waters Corp. produced lightweight aggregate by the Haydite method from a plant located near Centerville. Shale was used as raw material. Adel Clay products Co., of Centerville, produced brick and other heavy clay products from shale mined in the northern environs of Centerville.

Limestone was produced by three companies for highway and agricultural purposes. Paving sand and gravel was produced by the county highway department.

Bituminous coal was produced at eight underground mines. The operating companies were Appanoose Coal Co., Clarke Coal Co., D.C. Coal Co., New Block Coal Co., New Gladstone Coal Co., Number 4 Coal Co., Riverside Coal Co., and Shamrock Coal Co. Number 4 Coal Co. acquired the mine formerly operated by Sunshine Coal Co.

Black Hawk.—Concrete Materials Division, Martin Marietta Corp., and Pint's Quarry, Inc., produced crushed limestone for road construction and agricultural use. Sand and gravel was produced for commercial use by five companies operating both portable and stationary plants. Some sand was produced by the city of Waterloo.

Boone.—Refractory clay mortar was produced by Grarok, Inc., from a pit near Boone. Hallett Construction Co. produced sand and gravel for building, road construction, and fill from pits near Boone and Madrid.

Cass.—Limestone was produced for highway construction, agricultural purposes, and riprap by Missouri Valley Limestone Co., Inc., and Schildberg Construction Co., Inc. A small amount of building and paving sand was also produced.

Cerro Gordo.—Mineral production represented about 25 percent of the State total mineral value. Lehigh Portland Cement Co. and Northwestern States Portland Cement Co. manufactured portland cement and mortar mix, using locally produced limestone and clays. The Mason City Brick & Tile Co. mined clay for manufacturing heavy clay products.

Limestone for highway construction and agricultural uses was produced by Grupp Construction Co., Ideal Sand & Gravel Co., Weaver Construction Co., and Welp & McCarten, Inc. Lime was produced for internal use by the American Crystal Sugar Co. Clear Lake Sand & Gravel Co., Inc., and Ideal Sand & Gravel Co. operated stationary plants near Clear Lake and Mason City, respectively, and produced sand and gravel for building and road construction and other uses.

Clayton.—Limestone sold commercially was produced by five companies and used for road construction and agriculture. The county highway department quarried limestone for riprap. Concrete Materials Division, Martin Marietta Corp., mined a friable sandstone and processed it for use as a molding sand.

Dallas.—Clays used in the manufacture of building brick, and other heavy clay products were mined by Adel Clay Products Co., Redfield Brick & Tile Co., and United Brick & Tile Co. of Iowa. Sand and

gravel was produced by three companies for building and road use. The county highway department contracted for paving gravel. Limestone was produced near Dexter for road construction.

Des Moines.—United States Gypsum Co. operated a plant and mine near Sperry. Products manufactured included wallboard, sheathing, plaster-base lath, and other building products.

Limestone was produced by two companies from plants near Mediapolis and Burlington for use as riprap and roadstone. Sand was also produced for building, paving, and fill. The county highway department contracted for paving sand.

Dubuque.—Limestone used for architectural and rough construction was produced by Becker Stone Quarry. Dubuque Stone Products Co. produced crushed stone—chiefly for road construction and agricultural uses. The county highway department produced 20,000 tons of crushed limestone for road construction. Sand and gravel for building, paving, and fill was produced by Molo Sand & Gravel Co. from a portable plant near Dubuque.

Fayette.—Three companies and the county highway department produced crushed limestone for road construction and agricultural purposes. Sand and gravel was produced by two companies for building and road construction.

Floyd.—Clay was mined by the Rockford Brick & Tile Co., Rockford, for manufacturing heavy clay products. Four companies produced crushed limestone for road construction and agricultural purposes. Two companies produced sand and gravel—chiefly for use in building and road construction.

Franklin.—Sheffield Brick & Tile Co., Sheffield, produced clay for manufacturing heavy clay products. Sand and gravel was produced by three companies and the county highway department for building, road construction, and other uses. Limestone was produced by three companies operating portable and stationary plants for road construction and agricultural uses.

Hardin.—The Iowa Limestone Co. and Weaver Construction Co. produced limestone from quarries near Alden. Production was mainly for road construction, agricultural use, and miscellaneous filler. Sand and gravel was produced by five companies operating both portable and stationary plants. The material was used chiefly for building and road construction.

Jasper.—Kaser Construction Co. produced crushed limestone and sand and gravel, principally for road construction. Van Dusseldorp Construction Co. produced sand and gravel near Colfax for building, road construction, and fill.

Johnson.—Crushed limestone was produced by River Products Co. and Weaver Construction Co. from quarries near Iowa City. Production was used for road construction, railroad ballast, agricultural limestone, and riprap. Sand and gravel was produced by Stevens Sand & Gravel Co., Inc., from a portable plant near Iowa City. The material was used for building and road construction, and other uses.

Keokuk.—Nelson Clay Products Co. and Oskaloosa Clay Products Co., with pits near What Cheer, mined clay—chiefly for use in manufacturing heavy clay products. Limestone for highway and agricultural purposes was produced by Kaser Construction Co.

Linn.—Over $2 million worth of limestone and sand and gravel was produced by four limestone companies and four sand and gravel companies.

Lucas.—Big Ben Coal Co. produced nearly 39,000 tons of coal from an underground mine near Chariton. The Liberty Coal Mining Co. operated a strip mine near Knoxville.

Madison.—Over $3 million worth of limestone was quarried in the county by six companies and the county highway department. Marquette Cement Manufacturing Co. and Penn-Dixie Cement Corp. were two of the chief producers. The output from their quarries was used in the manufacturing of portland cement. Substantial tonnage of crushed limestone was also produced for concrete aggregate, road construction, and agricultural limestone. Marquette Cement Manufacturing Co. also mined clay for use in its cement plant in Polk County.

Mahaska.—Bituminous coal was produced by five companies operating seven strip mines. They were Angus Coal & Hauling Co., De Long Coal Co., Lost Creek Coal Co., Mich Coal Co., and Star Coal Co. The Shinn Coal Co., which was active in 1961, was idle throughout 1962. The De Long Coal Co. abandoned the two strip mines it operated in 1962.

Griffin Pipe Products Co., formerly What Cheer Clay Products Co., and Oskaloosa Clay Products Co. mined clay for manufacturing building brick and sewer pipe. Limestone was produced by Kaser Construction Co. for highway construction and agricultural use.

Marion.—About 57 percent of the bituminous coal produced in Iowa came from mines in Marion County. Coal was produced from three underground mines and nine strip mines. Underground producers were Good Coal Co., Lovilia Coal Co., and Walter Coal Co. Strip mines were operated by Beard Coal Co., Hopkins Coal Co., Jude Coal Co., Inc., Liter Coal Co., Inc., Newton Coal Co., Valley Coal Co., Ver Steege Coal Co., Weldon Coal Co., and Wilkinson Coal Co.

Three companies produced crushed limestone for road construction and agricultural use. Four companies produced sand and gravel, chiefly for highway and building construction.

Clay was removed as overburden from the Ver Steege Coal Co. operation near Knoxville and sold for use in manufacturing heavy clay products. Goodwin Tile & Brick Co. abandoned their pit in the county in late 1961.

Mitchell.—Crushed limestone was produced by three companies from six quarries using portable equipment. The companies were L. R. Falk Construction Co., Grupp Construction Co., and Kallman Quarries. Output was for road construction and agricultural use. Sand and gravel was produced by L. R. Falk Construction Co., Osage Sand & Gravel, and Seeber & Wetter. The material was used chiefly for road and building construction.

Monroe.—Kaser Construction Co. produced crushed limestone for road construction and agricultural use. Acme Coal Co. operated an underground bituminous coal mine and De Long Coal Co. and Weldon Coal Co. operated strip mines. Companies that did not operate in 1962 were Cedar Valley Coal Co. and C. N. Knox Coal Co.

Muscatine.—Sand and gravel was produced by Acme Fuel & Material Co., Hahn Brothers Sand & Gravel Co., Northern Gravel Co.,

Harold F. Storm, and Wendling Quarries, Inc. Production was from stationary and portable plants and used for highway and building construction, engine sand, sand blasting, filtration, and other uses. Wendling Quarries, Inc. also quarried limestone for road construction, agricultural use, and riprap.

Polk.—The county was second in the State in value of minerals produced. Marquette Cement Manufacturing Co. and Penn-Dixie Cement Corp. operated cement plants, producing portland cement types I, II, and III and masonry cement. Clay and limestone used by these two companies were produced in Madison County.

Des Moines Clay Co. and Goodwin Tile & Brick Co. mined clay and manufactured building brick and other heavy clay products. Sand and gravel was produced by seven companies for highway and building construction, railroad ballast, and other uses. Total value of mineral output in the county was $13 million.

Scott.—The county ranked third in mineral production in the State. Dewey Portland Cement Co., with a plant near Davenport, produced types I, II, and III portland cement and masonry cement, using clay and limestone from nearby company-owned sources.

Linwood Stone Products Co., Inc., produced quicklime and hydrated lime at its plant near Buffalo. It was the only commercial producer of lime in the State. The products were sold mainly for chemical and metallurgical uses. Crushed limestone was also produced by Weaver Construction Co. which operated four quarries utilizing portable crushing equipment. Production was utilized for building, road construction, and agriculture. Sand and gravel was produced by four companies, chiefly for highway and building purposes.

Story.—Heavy clay products were manufactured by the Nevada Brick & Tile Co. Limestone was produced by Ray Cook Construction Co., Inc., and Weaver Construction Co. for road construction and agricultural purposes. Sand and gravel was produced by Hallett Construction Co., Cook Construction Co., Inc., and Roberson Brothers from stationary and portable plants near Ames. Chief uses were for building, road construction, and fill.

Van Buren.—An underground limestone mine was operated by Douds Stone, Inc., near Douds. Limestone was also produced by Kaser Construction Co., Triangle Quarries, Inc., and the county highway department. Uses were for road construction, agriculture, and riprap. Paving sand and gravel was produced by two companies.

Laddsdale Coal Co., Inc., produced 18,000 tons of bituminous coal from a strip mine near Eldon.

Wapello.—Oskaloosa Clay Products Co. and Ottumwa Brick & Tile Co. mined clay for the manufacture of brick and other heavy clay products. Wapello Stone Quarries produced limestone near Ottumwa for road construction, agricultural use, and riprap. Sand and gravel was produced by Concrete Materials Division, Martin Marietta Corp., and Maudlin Construction Co., chiefly for road construction.

Bituminous coal was produced from two strip operations. Companies operating were New Lanning Coal Co., Inc., and South Iowa Coal Co. Van Fossan Coal Co. had produced in 1961 but was not active in 1962. Airline Coal Sales Co. produced less than 1,000 tons.

Webster.—Gypsum was mined by open-pit methods by Bestwall Gypsum Co., The Celotex Corp., National Gypsum Co., and United States Gypsum Co. Each company operated processing and fabricating facilities.

Limestone was produced from an underground mine by Fort Dodge Limestone Co., Inc. Northwestern Limestone Co. also produced crushed limestone. All stone was used for road and building construction and for agricultural purposes. Sand and gravel worth about $200,000 was produced by four companies and the county highway department.

Johnson Clay Works, Inc., Kalo Brick & Tile Co., Lehigh Sewer Pipe & Tile Co., and Vincent Clay Products Co. mined clay. Manufactured products included building brick, building tile, sewer pipe, and other heavy clay products.

Winnebago and Worth Counties.—Moss, reed-sedge, and humus peat were produced by Eli Colby Co. and Colby Pioneer Peat Co. Peat was processed in plants near Hanlontown.

Limestone and sand and gravel were also produced in these counties.

The Mineral Industry of Kansas

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of Kansas for collecting information on all minerals except fuels.

By A. Kuklis [1], W. W. Mankin [2], E. D. Goebel [3], A. L. Hornbaker [3], and R. G. Hardy [3]

MINERAL production in Kansas in 1962, valued at $501.1 million, brought the total value of minerals produced in the State since 1861 to about $10 billion. Mineral fuels and related products again constituted the largest part—$432.0 million or 86 percent of the total value.

Of the 15 minerals produced in Kansas, output of 11 was greater than in 1961. Increased production was reported for zinc and most of the nonmetals. Construction material output was up more than 2 percent, owing to increased requirements of the heavy building industry. Mineral fuels production value was more than $10 million over that of 1961. The five principal minerals in order of value were petroleum, natural gas, cement, stone, and natural gas liquids.

Value of construction contracts in Kansas for 1962 increased approximately 10 percent and was reflected in a greater demand for Kansas-produced construction materials such as cement, clay, gypsum, sand and gravel, and stone.[4] Construction activity was greater near centers of population and in areas of major public works. The impetus in construction did not measurably increase employment in the mineral industry because more portable and automated equipment and plants were utilized.

Production of electrical energy was more than 7 percent greater than in 1961.[5] Increased production and a greater demand for coal resulted from expansion of markets and a prolonged and severe winter. Plants producing electrical energy in Kansas are fueled by natural gas; stockpiles of coal are maintained as standby fuel for use when flow of gas is interrupted during cold weather intervals.

Western Light & Telephone Co. was building an $8 million electric-power generating plant east of Liberal. Scheduled for completion in October 1963, the powerplant will supply energy to the world's largest helium plant, currently under construction by National Helium Corp.

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[3] Geologist, State Geological Survey of Kansas, The University of Kansas, Lawrence, Kans.
[4] F. W. Dodge. Dodge Construction Statistics, January 1963.
[5] University of Kansas, Center for Research in Business. Kansas Business Review. V. 16, No. 2, 1962.

TABLE 1.—Mineral production in Kansas[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland—thousand 376-pound barrels	8,028	$25,605	8,058	$25,134
Masonry—thousand 280-pound barrels	379	1,156	392	1,156
Clays—thousand short tons	954	1,225	895	1,091
Coal—do	664	3,102	915	4,249
Helium—thousand cubic feet	23,251	434	42,305	1,478
Lead (recoverable content of ores, etc.)—short tons	1,449	298	970	178
Lime—thousand short tons	15	193	5	59
Natural gas—million cubic feet	649,083	81,135	694,352	86,100
Natural gas liquids:				
Natural gasoline—thousand gallons	132,180	5,790	151,360	7,696
LP gases—do	135,643	5,916	166,769	6,295
Petroleum (crude)—thousand 42-gallon barrels	112,241	324,376	[2] 112,076	[2] 326,141
Salt[3]—thousand short tons	913	11,409	944	11,654
Sand and gravel—do	11,366	7,781	11,552	8,039
Stone[4]—do	12,328	16,411	13,527	17,274
Zinc (recoverable content of ores, etc.)—short tons	2,446	563	3,943	907
Value of items that cannot be disclosed: Natural cement, gypsum, pumice, salt (brine), stone (crushed sandstone)		3,204		3,625
Total		[5] 488,598		501,076

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Preliminary figure.
[3] Excludes salt in brine included with "Value of items that cannot be disclosed."
[4] Excludes certain stone included with "Value of items that cannot be disclosed."
[5] Revised figure.

Employment and Injuries.—According to the Kansas Industrial Development Commission, 10 new mineral producers were incorporated during 1962 in Kansas, and provided employment for about 300 workers. Economic growth in the mineral industry was not sufficient to generate a net increase in workers employed; data released by the Employment Security Division, Kansas Department of Labor, show that mineral industry employment declined to 15,700 workers. The decline in employment was attributed to a leveling off in crude oil production, an increase in intrastate imports of mineral fuels and related products, and a general increase in automation throughout the mineral industry.

The average work week in the mineral industry increased from 43 hours in 1961 to 49.6 hours in 1962, thus resulting in a higher average weekly wage for the worker. The coal miner received the highest wages in the industry, averaging $167.08 per week during 1962. In

TABLE 2.—Average annual employment for selected mineral industries

Industry	1953–57 (average)	1958	1959	1960	1961	1962
Mining (total)	18,680	18,200	18,300	16,900	16,200	15,700
Metal mining	370	100	(1)	(1)	(1)	100
Mining and quarrying of nonmetallic metals, except fuels	1,800	1,800	1,900	1,700	1,600	1,500
Bituminous coal and lignite mining	420	300	300	300	300	300
Crude petroleum and natural gas	16,090	16,000	16,100	14,900	14,300	13,800
Petroleum refining and related industries	5,020	4,800	4,900	4,700	4,600	4,500

[1] Employment estimated to be less than 100.

Source: Employment Security Division, Kansas Department of Labor.

comparison, average weekly wages for workers in oil refining, mining, and crude petroleum were $123.07, $106.30, and $105.88, respectively.

The Workmen's Compensation Commission, State of Kansas, reported that 1,026 on-the-job injuries occurred in the mineral industry during 1962. Fifteen of these were fatal.

Legislation and Government Programs.—At yearend, the State Legislative Council had approved and sent to the Kansas Legislature a proposed lease unitization measure designated as Bill No. 6. As drafted, it would give the State Corporation Commission authority to set well-spacing patterns for new drilling, integrate leases for purpose of drilling development, and order fieldwide unitization of established fields. Proponents believe that approval of Bill No. 6 would attract more drilling and capital to Kansas and increase development of oil and gas reserves; opponents argue that unitization would reduce well drilling in Kansas and generally depress all segments of the State's oil and gas industry.

Early in 1962, the Department of the Interior and the U.S. Army Corps of Engineers announced a new joint land acquisition policy that would increase the acreage of land purchased by the Federal Government for reservoir projects. It authorizes the Federal agencies to acquire title to land within a reservoir lying below the maximum elevation necessary to safeguard against saturation, wave action, and bank erosion; land needed to provide public access; and land needed to meet present and future requirements for recreation and fish and wildlife.

The State Highway Commission announced that highway-construction contracts approved during the year increased by more than $10 million. Projects authorized included construction of 609 miles of road and 149 bridges for interstate and State routes, 119 bridges and 625 miles of improvements for county secondary roads. A total of 408 miles of State and interstate highway was opened to traffic in 1962. Since enactment of the Federal Highway Act in 1956, a total $184.8 million has been allocated to Kansas. Of this amount, 74.5 percent has been expended, 13.8 percent was programed as of December 31, 1962, and the remaining 11.7 percent had not been obligated.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Substantial increases in production value were reported for mineral fuels in Kansas; natural gas gained most, followed by natural gas liquids, petroleum, and coal. The $1 million rise in value of helium shipments was in part due to a price increase from $19 to $35 per thousand cubic feet.

Carbon Black.—Output of carbon black increased 14 percent in both volume and value. Increased quantities of natural gas liquids were used in manufacturing carbon black, replacing natural gas as feedstock. The material was processed in furnace-type plants of Columbian Carbon Co. at Hickok and United Carbon Co. at Ryus in Grant County. The United Carbon plant, built during World War II, was determined obsolete and dismantled at yearend.

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TABLE 3.—Carbon black production

	1959	1960	1961	1962
Carbon black produced, all grades—pounds	91,644,160	87,302,185	89,936,075	102,282,466
Value at plants	$6,387,598	$5,621,236	$6,243,192	$7,118,849
Natural gas processed—thousand cubic feet	4,624,404	3,914,444	3,645,118	3,564,057
LP gases and other liquid fuel processed—barrels	390,063	398,415	361,005	422,401

Source: Kansas Corporation Commission.

Coal (Bituminous).—Production of bituminous coal, totaling 914,999 tons valued at $4.2 million, increased 38 percent in volume and 37 percent in value. Increased output was primarily due to a prolonged and severe winter. Manufacturing and power plants used large quantities of coal normally stockpiled as standby fuel intended for use when the supply of natural gas is interrupted.

Eleven coal mines reported output of more than 1,000 tons; all except one were open-pit mines; six mines in Crawford, Linn, and Osage Counties produced less than 1,000 tons each. According to the Kansas Labor Department, coal mines operated a total of 2,232 work days and employed 315 workers. Average value per ton of coal, f.o.b. mine, was $4.64, 3 cents lower than in 1961.

The coal mining industry in Kansas began with development and building of the Nation's railroads to the west coast and reached its peak at the close of World War I. Cumulative production of coal in Kansas totals more than 281 million tons, of which nearly 60 percent was produced prior to 1920.[6] Decline of the industry was attributed to widespread use of liquid hydrocarbons and gas as substitute fuels for coal. Recoverable reserves were estimated at 10,374 million tons, assuming 50 percent recovery.[7]

Coal research by Government and industry continued as a means of improving coal's position in the energy market. To supplement research by the Bureau of Mines, Office of Coal Research, U.S. Department of Interior, awarded a coal research contract to Spencer Chemical Co. The study, conducted at the company Merriam, Kans., laboratory, is expected to result in new products and methods which would lead to increased consumption of coal. The possibility of producing humic acid from Kansas coals for use as a soil conditioner was being investigated by the Kansas Geological Survey.

TABLE 4.—Coal (bituminous) production

(Excludes mines producing less than 1,000 short tons)

Year	Number of mines			Short tons (thousands)	Value (thousands)
	Underground	Strip	Total		
1953-57 (average)				1,092	$4,611
1958	2	13	15	823	3,711
1959	2	11	13	772	3,607
1960	2	11	13	888	4,197
1961	1	9	10	664	3,102
1962	1	10	11	915	4,249

[6] Bureau of Mines. Minerals Yearbook, 1961. V. II, 1962, p. 69.
[7] Page 56 of work cited in footnote 6.

Helium.—Helium shipments reported by the Bureau of Mines Otis helium plant in Rush County totaled 42 million cubic feet, an increase of 82 percent. The gas was extracted from helium-bearing natural gas obtained from wells in Barton, Rush, and Pawnee Counties. Value of shipments totaled almost $1.5 million, an increase of more than $1 million over that of 1961.

Increased shipments were due to wider application of helium in atomic energy, electronic industry, rocketry, and greater requirements by scientific research institutes. The increase in value was partly due to a price increase from $19 to $35 per thousand cubic feet instituted on November 18, 1961. The new price was calculated to cover all costs of carrying out provisions of the revised Helium Act (Public Law 86–777), which includes repayment with interest on all capital assets and funds that are borrowed to sustain the helium-conservation program.

New helium production facilities in Kansas—contracted with private industry to implement a long-range helium-conservation program—were in various stages of construction. Helex Co., subsidiary of Northern Natural Gas Co., completed its plant near Bushton, Rice County, at midyear; however, no production was reported for 1962. Plants currently under construction by Cities Service Helex, Inc., and National Helium Corp. were scheduled for completion in early 1963. Helium will be extracted from gas enroute to fuel markets by the private plants and transported in a Bureau of Mines pipeline system to the Government-owned Cliffside gasfield near Amarillo, Tex., for storage until needed to meet future industry requirements.

Cities Service awarded a contract to Fluor Corp. of Los Angeles for designing, engineering, and constructing a $10 million helium plant near Ulysses. The project was initiated at midyear; completion was scheduled for early 1963. Late in 1961, the Bureau of Mines awarded a contract to Williams Brothers, Tulsa, Okla., for engineering and constructing a 425-mile pipeline from Bushton, Kans., to the Cliffside storage field northwest of Amarillo, Tex. The main line contains laterals to private helium plants for helium conservation at Ulysses and Liberal, Kans., Hansford County, Tex., and Dumas, Tex. The line is also connected to the Bureau of Mines plant at Otis, Kans., Keyes, Okla., and Exell, Tex. The project was completed at yearend.

Natural Gas.—Marketed production of natural gas, 694,352 million cubic feet, valued at $86 million, was the highest in the history of the Kansas industry. The 7-percent gain was partly due to Kansas Corporation Commission's ruling that pipeline companies take Kansas gas in proportion to their purchases from competitive states.

Natural gas was produced from approximately 7,000 gas wells located mostly in the southwestern part of the State. Kansas ranked fifth in marketed production among the producing states. The Hugoton gasfield area, in Finney, Grant, Hamilton, Haskell, Kearny, Morton, Seward, Stanton, and Stevens Counties, supplied 74 percent of the State's total.

The Kansas Geological Society Nomenclature Committee and the State Conservation Commission reported 30 gas discoveries in 1962;

of these 19 were gasfield openers, 10 were new gas zones in old oilfields, and 1 was a revised gasfield.

TABLE 5.—Marketed production of natural gas

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1953-57 (average)	483,360	$51,700	1960	634,410	$74,226
1958	561,816	64,047	1961	649,083	81,135
1959	604,410	72,529	1962	694,352	86,100

TABLE 6.—Marketed production of natural gas from the Kansas part of Hugoton gas area

Year	Million cubic feet	Year	Million cubic feet
1943	70,922	1953	387,635
1944	92,923	1954	346,732
1945	90,345	1955	394,257
1946	119,638	1956	381,875
1947	157,663	1957	396,889
1948	185,873	1958	349,264
1949	247,869	1959	404,764
1950	320,545	1960	451,820
1951	371,002	1961	467,842
1952	375,082	1962	518,069

Source: 1952-57 data from Oil and Gas Developments in Kansas During 1957. State Geol. Survey of Kansas, Univ. of Kansas Pub. Bull. 133, 1958, p. 33. 1958-62 data from Conservation Division, Kansas Corporation Commission.

TABLE 7.—Important new gasfields discovered in 1962

(Thousand cubic feet per day)

Pool or field	County	Initial production
Brooks	Barber	7,400
Whitacre	Cowley	4,300
Ryus Townsite	Grant	1,210
Prather	Kingman	2,800
Einsel	Kiowa	4,800
Huntsville	Reno	6,650
McClintock	Rice	3,000
Basgall West	Rush	12,242
Condit	Seward	4,600
Iris	do	8,800
Liberal East	do	7,645
Grigsby	Stevens	1,400
Kel	do	1,500

Source: State Geol. Survey of Kansas, Oil and Gas Developments in Kansas During 1962. Bull. 166 (advance).

At yearend, natural gas stocks in storage rose to 89 billion cubic feet, 11 percent higher than at the same time last year.

A detailed survey of underground storage of natural gas was conducted by the Interstate Oil Compact Commission. The report contained a State-by-State review of the geology of present reservoirs and prospects of future natural gas storage reservoirs.[8]

[8] Interstate Oil Compact Commission. Underground Storage of Natural Gas in the U.S. Oklahoma City, Okla., May 1962.

TABLE 8.—Leading gasfields[1]

(Million cubic feet)

Field	County	Discovery date	Annual production			Cumulative production Dec. 31, 1962
			1960	1961	1962	
Hugoton Gas Area	(2)	1930	451,820	467,842	518,069	6,452,213
Greenwood Gas Area	Morton	1951	38,695	39,771	31,277	345,784
Medicine Lodge-Boggs	Barber	1927	6,677	5,058	5,150	267,430
Spivey-Grabs-Basil	Harper-Kingman	1949	19,329	24,953	28,353	124,587
Hardtner	Barber	1954	7,811	6,340	5,061	69,857
Rhodes	do	1954	11,560	9,832	6,616	71,057
McKinney	Clark-Meade	1950	6,888	7,804	7,166	53,009
Boggs Southwest	Barber	1955	4,856	3,207	2,686	43,045
Sparks	Morton-Stanton	1954	5,952	6,360	5,243	36,295

[1] Fields with cumulative production in excess of 30,000,000,000 cubic feet.
[2] Stevens, Grant, Kearny, Finney, Haskell, Morton, Seward, Stanton, and Hamilton Counties (in descending order of cumulative production).

Source: State Geological Survey of Kansas, Oil and Gas Developments in Kansas During 1962. Bull. 166 (advance).

Natural Gas Liquids.—Recovery of natural gas liquids at 15 plants increased 19 percent in volume and 20 percent in value. The average price per gallon of natural gas liquids was 4.4 cents, unchanged from that of 1961. Of the total output, LP gases comprised 52 percent and natural gasoline, 48 percent.

The average yield of natural gas condensate obtained from each thousand cubic feet of gas processed was 0.598 gallons in 1962 compared with 0.527 gallons in 1961. Most of the plants are located in the southwestern part of the State and process natural gas produced in the Hugoton gas area.

TABLE 9.—Natural gas liquids production

(Thousand gallons and thousand dollars)

Year	Natural gasoline		LP gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	114,555	$6,197	91,816	$3,231	206,371	$9,428
1958	110,293	6,229	115,175	5,193	225,468	11,422
1959	107,814	5,576	124,874	6,658	232,688	12,234
1960	115,868	6,694	127,270	6,343	243,138	13,037
1961	132,180	5,790	135,643	5,916	267,823	11,706
1962	151,360	7,696	166,769	6,295	318,129	13,991

Nearly half of the LP gas output was used for heating and cooking by residential and commercial customers. The petrochemical industry demanded considerable amounts of LP production and remained the second largest consumer. New materials and fabrics that would require additional production were being developed.

Record sales of new cars in 1962, resulting in a large net addition to the country's vehicle fleet, were believed to have stimulated increased output of natural gasoline. Large quantities of the liquids were utilized in blending gasoline.

Round and Stewart's natural gasoline plant in Marion County was placed on stream at midyear and had a daily capacity of 30 million

TABLE 10.—Natural gasoline and LP gases produced in 1962

(Barrels)

Company	Location		Natural gasoline	Butane	Propane	LP gases	Total
	Nearest town	County					
Cities Service Petroleum Co.	Wichita	Sedgwick	292,605	437,809	327,389		1,057,803
Colorado Interstate Gas Co.	Lakin	Kearny	111,023				111,023
Hugoton Production Co.	Ulysses	Grant	139,363	163,008	171,936		474,307
Kansas Hydrocarbon Co.	Cheney	Sedgwick	75,809	23,119	53,512		152,440
Kansas-Nebraska Natural Gas Co.	Deerfield	Kearny	83,810		26,081	57,355	167,246
Northern Natural Gas Co.	Holcomb	Finney	143,484				143,484
Do.	Sublette	Haskell	438,695				438,695
Pan American Petroleum Corp.	Ulysses	Grant				55,935	55,935
Do.	do.	do.	578,546	679,660	451,473	91,185	1,800,864
Panhandle Eastern Pipe Line Co.	Liberal	Seward	483,053	227,611	136,455		847,119
Rounds & Stewart Natural Gasoline Co., Inc.	Marion	Marion	158,402	166,641	235,491		560,534
Skelly Oil Co.	Medicine Lodge.	Barber	81,905		78,704		160,609
Do.	Minneola	Ford	75,370		54,861		130,231
Socony Mobil Oil Co., Inc.	Ulysses	Grant	256,878	76,876	118,284		452,038
Do.	Spivey	Kingman	261,416	133,097	212,303		606,816

Source: Kansas Corporation Commission.

cubic feet of natural gas; Antelope and Lost Springs gasfields supply the feedstock. Pan American's Kinsler plant, in Grant County, was placed on stream at yearend and would extract liquids from natural gas produced in the Hugoton Deep gasfield of Grant, Morton, and Stanton Counties. Construction of the Northern Natural Gas Co. plant in Rice County was completed in 1961, but court action instituted by a competing company precluded building necessary pipeline facilities. When operating at capacity, the plant will process 900 million cubic feet of natural gas daily, thereby making it the world's largest plant.

Petroleum.—Crude oil production from 81 counties approximated that of 1961 in quantity and value. Oil was produced from approximately 46,750 wells, most of them in the western half of the State. The Kansas Geological Society Nomenclature Committee and the State Conservation Commission reported 160 oil discoveries in 1962; of these, 97 were oilfield openers, 48 were new oil zones in oilfields, and 15 were revived oilfields.

The petroleum refining industry operated at about 83 percent capacity. Reduced levels of crude oil production were attributed to seasonal declines in demand for petroleum products, inventory adjustments, imports, and competition from gas and natural gas liquids. Major expenditures by oil companies were confined to areas of refining which would provide improvement in quality of products and operating efficiency.

Kansas ranked sixth among the oil-producing States. At yearend, the State had produced a cumulative total of more than 3.5 billion barrels of oil valued at $7.5 billion.

On January 1, 1962, Kansas had 40,951 stripper wells producing oil during 1961—427 wells more than in 1960.[9] Yield of the stripper wells was 73.6 million barrels, about 66 percent of the State's output. Oil reserves attributed to these wells were estimated at 561 million barrels.

TABLE 11.—Crude petroleum production

(Thousand barrels and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	120,674	$340,547	1960	113,453	$329,014
1958	119,942	359,826	1961	112,241	324,376
1959	119,543	347,870	1962 [1]	112,076	326,141

[1] Preliminary figures.

TABLE 12.—Crude petroleum production, indicated demand and stocks in 1962, by months

(Thousand barrels)

Month	Production	Indicated demand	Stocks originating in Kansas (end of month)	Month	Production	Indicated demand	Stocks originating in Kansas (end of month)
January	9,035	9,529	7,918	September	9,076	9,212	6,922
February	8,659	8,568	8,009	October	9,774	9,159	7,537
March	9,688	9,831	7,866	November	9,268	8,777	8,028
April	9,320	8,206	8,980	December	9,407	9,228	8,207
May	9,629	10,005	8,604				
June	9,266	9,428	8,442	Total:			
July	9,458	10,259	7,641	1962 [1]	112,076	112,281	
August	9,496	10,079	7,058	1961	112,241	113,227	

[1] Preliminary figures.

TABLE 13.—Pipeline runs of crude petroleum by fields [1]

(Thousand barrels)

Field [2]	1958	1959	1960	1961	1962
Bemis-Shutts	5,063	4,868	4,472	4,116	3,988
Chase-Silica	3,260	3,689	3,219	2,919	3,902
El Dorado	4,371	4,443	4,291	4,239	3,986
Geneseo-Edwards	1,812	1,680	1,565	1,529	1,454
Gorham	1,499	1,421	1,311	1,238	1,196
Hall-Gurney	3,296	3,253	3,229	3,291	3,199
Kraft-Prusa	3,092	2,890	2,526	2,317	2,147
Lost Springs	495	1,704	1,914	2,350	1,848
Marcotte	1,779	1,596	1,424	1,258	1,163
Morel	1,477	1,354	1,299	1,239	1,227
Pleasant Prairie	254	1,369	1,839	1,719	1,676
Ray	1,353	1,363	1,289	1,306	1,322
Ritz-Canton	1,542	1,321	1,199	1,120	1,396
Spivey-Grabs-Basil	1,961	2,370	2,492	3,726	3,949
Trapp	3,366	3,120	2,752	2,542	2,439
Other fields [3]	85,322	83,062	78,523	77,302	77,134
Total	119,942	119,503	113,344	112,211	112,026
Change in field stocks [3]		+40	+109	+30	+50
Total production [3]	119,942	119,543	113,453	112,241	[4] 112,076

[1] Fields with current annual pipeline runs in excess of 1 million barrels.
[2] Breakdown for individual fields from Kansas Geological Survey.
[3] Bureau of Mines figures.
[4] Preliminary figure.

[9] Oil and Gas Journal. October 1962, p. 103.

TABLE 14.—Important new oilfields discovered in 1962

(Barrels per day)

Field	County	Initial production
Mingona	Barber	247
Nuss South	Barton	81
Overstreet	Butler	100
Little Beaver Creek	Cheyenne	85
Antonino South	Ellis	101
Rushville	Ford	100
Riedel	Graham	132
Annelly	Harvey	30
Eakin	Hodgeman	12
Jarnagin	do	113
Lappin	do	166
Demand	Lane	99
Pendennis South	do	131
Selfridge	do	102
Dickman	Ness	76
Dumler	do	71
Gereke Northwest	Pratt	515
Beeson	Rawlins	249
Cahoj West	do	115
Tobias Northwest	Rice	100
Ang North	Seward	360
Evalyn Southeast	do	542

Source: State Geological Survey of Kansas, Oil and Gas Developments in Kansas During 1962. Bull. 66 (advance).

TABLE 15.—Leading oilfields[1]

(Thousand barrels)

Field	County	Discovery date	Annual production			Cumulative production		
			1960	1961	1962	Dec. 31, 1960	Dec. 31, 1961	Dec. 31, 1962
El Dorado	Butler	1915	4,291	4,239	3,986	245,474	249,713	253,670
Chase-Silica	Barton, Rice, Stafford	1931	3,219	2,919	2,902	218,536	221,455	224,357
Bemis-Shutts	Ellis, Rooks	1935	4,472	4,116	3,988	175,980	180,096	184,084
Trapp	Barton, Russell	1936	2,752	2,542	2,439	167,213	169,755	172,195

[1] Fields with cumulative production in excess of 100 million barrels.

Source: State Geological Survey of Kansas, Oil and Gas Developments in Kansas During 1962. Bull. 166 (advance).

Secondary Recovery Projects.—Recovery of oil by secondary methods increased to about 21 million barrels and accounted for about 19 percent of the petroleum output. More than 800 secondary recovery projects were active in the State. New projects authorized by the Kansas Corporation Commission during 1962 totaled 144 as compared with 146 for the previous year.

Secondary recovery projects utilize air, gas, or water as a displacement medium in oil-bearing strata. Water injection methods produced most of the secondary recovery oil in Kansas. Important formations being waterflooded were the Bartlesville, Peru, and Wayside Sands.

Two large waterflood projects were being developed, one by Cities Service Co. (El Dorado), the other by Home-Stake Production Co. (Keighley). The fields include an area in excess of 2,200 acres; water-

flooding is expected to add 20 years to the producing life of the fields.

At yearend, Layton Oil Co. and Frankfort Oil Co. purchased waterflood properties from Allied Chemical Corp., located in Allen, Franklin, Montgomery, and Neosho Counties, all in eastern Kansas.

State Regulations.—The Conservation Division of the Kansas Corporation Commission prevents waste of all mineral fuels (liquid and gaseous hydrocarbons) and supervises and protects the correlative rights of individuals in Kansas. Numerous rulings affecting the petroleum industry were instituted during the year; some of the more important decisions—

1. Modified the State's pipe rules by ordering oil and gas well drillers to set casing 25 feet below the deepest well within a 1-mile radius supplying water for domestic use or the deepest well within a 3-mile radius supplying water to a city or town.
2. Ruled that disposal of salt water must be made into wells having a minimum depth ranging from 200 to 700 feet, depending on the underlying formation in the area.
3. On November 11, ordered oil and gas producers in the Antelope (Lost Springs), Dobbs, and Hillsboro fields of Marion County to stop flaring gas.
4. Reinstated a 1944 rule permitting dual completion wells producing oil and gas separately from two pay zones.
5. Ruled that a "reasonable cost" for gathering and delivering natural gas in the Spivey-Grabs field of Kingman and Harper Counties is 2.5 cents per thousand cubic feet.
6. Allowed resumption of production in the Taloga oil and gas pool in Morton County.

Pipelines.—Pipelines transport vast quantities of oil, natural gas, and natural gas liquids in and out of Kansas and, as such, constitute an important segment of the hydrocarbon industry in the State. Transportation across the State's borders and construction of new pipelines are regulated by State and Federal agencies; namely, Kansas Corporation Commission, Interstate Commerce Commission, and Federal Power Commission.

At the end of 1961, a total of 14,872 miles of multiproduct pipelines was in use in Kansas for transporting liquid and gaseous hydrocarbon products.[10] Of this total, 6,794 miles were gathering lines (crude and natural gasoline), 4,166 miles product lines, and 3,912 miles crude trunklines.

Mileage of new pipeline laid during 1962 increased considerably over that of the previous year. Six major pipeline companies completed projects in the State; one other pipeline project was in the construction phase. Cities Service Co., Kansas-Nebraska Natural Gas Co., Northern Natural Gas Products Co., and Panhandle Eastern had projects valued at $37.6 million approved by regulatory agencies at yearend; construction was expected to start early in 1963. Skelly Oil Co. purchased the 633-mile, crude oil pipeline facilities of Service Pipe Line Co.; 182 miles of the facilities are trunklines and 451 miles are gathering lines.

[10] Bureau of Mines. Crude-Oil and Refined-Products Pipeline Mileage in the United States, Jan. 1, 1962. Mineral Industry Survey, August 1962, 9 pp.

Pumping station facilities, costing more than $5 million, were in various stages of construction. Completion of expansion projects by five major companies will increase compressor capacity by 23,000 horsepower.

Technological advances in field welding resulted in extensive use of high-frequency resistance welding and carbon dioxide welding. The industry was conducting research in material movement in pipelines; indications were that it is economically feasible to transport by pipeline coal, grain, pulp products, and plastic containers filled with a variety of goods.

Drilling and Exploration.—Selectivity was the key to exploration for Kansas oil and gas during 1962. All economic factors were weighed in choosing a drilling site. Results were impressive as new oil and gasfield discovery wells totaled 116, compared with 100 recorded for 1961.

Wells drilled in Kansas in 1962 totaled 3,803, an increase of 468 or 11 percent.[11] In addition to the reported well drilling, an estimated 560 wells were drilled in eastern Kansas, according to permits filed with the Kansas Corporation Commission.

Drilling activity was greater in the Central Kansas Uplift than in other regions of the State because of lower exploration cost and a greater success ratio. Shallow horizons in the eastern counties have been drilled extensively; deeper exploratory drilling here would entail greater expenditures.

Most significant discovery of the year was the Anadarko Production Co. shallow gas well in Morton County. Production rate was 3.6 million cubic feet daily from the Red Cave sand formation at a depth of 1,170 feet. This particular sand formation is widely distributed over a three-State area (Kansas, Oklahoma, and Texas), and the discovery started a wave of drilling and development activity in the southwestern part of Kansas.

Petrochemicals.—Cooperative Farms Chemical Co. in Lawrence was constructing additional plant capacity at a cost of $7 million to increase production of ammonia from 400 to 500 tons per day and nitric acid from 550 to 950 tons per day. Completion of the project, the sixth major expansion since the plant was built in 1954, was scheduled for September 1963.

The Skelly Oil Co. petrochemical complex will be operated in conjunction with its refinery in El Dorado; completion of the project was scheduled for October 1963. The plant will utilize a series of highly automated processes for converting a naptha fraction obtained from the refinery into 30 million pounds yearly of acetone, benzene, and cumene, and 50 million pounds yearly of phenol, toluene, and xylene. Phenol, one of the principal products, is a primary raw material used in manufacture of nylon and plastics.

Derby Refining Co. was evaluating engineering data for construction of a petrochemical complex situated near its refinery in Wichita.

[11] Goebel, E. D., and Others. State Geological Survey of Kansas, 1962, Bulletin 166 (advance).

TABLE 16.—Oil and gas well drilling in 1962

County	Wells drilled						
	Oil	Gas	Oil and gas	Service [2]	Dry	Unclassified [1]	Total
Allen	40			35		105	180
Anderson	10			2		13	25
Barber	10	11	2		43		66
Barton	92	2		3	94		191
Bourbon	2					8	10
Butler	75			23	64		162
Chase	4				3		7
Chautauqua	24			1	11	52	88
Cheyenne	1				6		7
Clark	2	8	2		10		22
Clay					3		3
Comanche	1	5	1		14		21
Cowley	50	2		7	75		134
Crawford	10			7		49	66
Decatur	9				33		42
Dickinson					2		2
Douglas	4				1	11	16
Edwards	13	1	1		25		40
Elk	8			1	7	10	26
Ellis	75			6	97		178
Ellsworth	10			1	9		20
Finney	18	8			18		44
Ford	1				7		8
Franklin	15			3	1	30	49
Geary					4		4
Gove	5				4		9
Graham	33			2	63		98
Grant		6			4		10
Gray					2		2
Greenwood	70	2		19	32		123
Hamilton		19			5		24
Harper	3	1	1		19		24
Harvey	21	2		23	23		69
Haskell	26	3	6	1	22		58
Hodgeman	51				32		83
Jackson					1		1
Johnson	3					12	15
Kearny		2			3		5
Kingman	42	10	18	2	40		112
Kiowa	5	4	1	1	23		34
Labette	5			5		10	20
Lane	3	1		1	9		14
Lincoln					1		1
Linn	2			2		4	8
Logan					7		7
Lyon	2				6		8
McPherson	42			6	34		82
Marion	75	16	5	1	50		147
Meade		9			13		22
Miami	10			15		45	70
Montgomery	10			6		29	45
Morris	1	1			4		6
Morton	18	22	4		21		65
Nemaha					1		1
Neosho	25			40		35	100
Ness	31			12	46		89
Norton	3				24		27
Osborne	1				1		2
Pawnee	9	8	1	1	15		34
Phillips	5			2	10		17
Pratt	15	4	3		43		65
Rawlins	7				12		19
Reno	13	4		6	36		59
Rice	104	3	2	2	60		171
Riley					11		11
Rooks	62			8	51		121
Rush	10	23		1	36		70
Russell	90			41	42		173
Saline	38			2	12		52
Scott					4		4
Sedgwick	22			1	31		54
Seward	31	12	7	1	18		69
Sheridan				8	6		14
Sherman					1		1
Smith					2		2

See footnotes at end of table.

TABLE 16.—Oil and gas well drilling in 1962—Continued

County	Wells drilled					Unclassified [1]	Total
	Oil	Gas	Oil and gas	Service [2]	Dry		
Stafford	79	3		7	103		192
Stanton		3			12		15
Stevens	3	6	7		10		26
Sumner	13				54		67
Thomas					2		2
Trego	14			1	35		50
Wabaunsee					2		2
Wallace					5		5
Wichita	1				5		6
Wilson	37	4		35	6	78	160
Woodson	18			23		69	110
Total:							
1962	1,532	205	61	364	1,641	560	4,363
1961	1,315	221	87	227	1,485	904	4,239

[1] Estimate.
[2] Service wells are waterflood wells, water-input wells, and salt-water disposal wells.

Source: State Geological Survey of Kansas. Oil and Gas Developments in Kansas During 1962. Bull. 166 (advance).

TABLE 17.—Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Product	Proved reserves, Dec. 31, 1961	Changes in proved reserves, due to extensions and new discoveries in 1962	Proved reserves, Dec. 31, 1962 (production was deducted)	Changes from 1961, percent
Crude oil—thousand barrels	878,027	95,842	862,410	−2
Natural gas liquids [1]—do	183 579	2.991	179,096	−2
Natural gas—million cubic feet	19,190,005	209,956	18,668,561	−3

[1] Includes condensate, natural gasoline, and LP gases.

Source: American Gas Association, American Petroleum Institute, and Canadian Petroleum Association. Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas. V. 17, Dec. 31, 1962, pp. 11, 12, 21.

NONMETALS

Production value of eight nonmetals totaled $68 million, an increase of $1 million over that of 1961. The more important, in order of value, were cement, stone, salt, and sand and gravel. Value of Federal- and State-financed construction projects rose in 1962 and resulted in increased output of five of six construction-related minerals. Production of salt brines utilized in chemical manufacturing gained in volume and value.

Cement.—Shipments of portland cement increased in quantity but decreased in value. The lower value resulted from a 7-cent-per-barrel drop in average price. At yearend, about 1.5 million barrels of portland cement was in stock, 10 percent more than in 1961. Portland cement was produced by six companies operating in five counties in eastern Kansas. About 64 percent of the portland cement was produced by the wet process and 36 percent by the dry process.

Sales of masonry cement increased 3 percent in quantity. The average price was $2.95 per barrel, 10 cents less than in 1961. Seven

plants prepared masonry cement by mixing portland cement, finely ground limestone, and a plasticizer additive.

TABLE 18.—Portland cement production and shipments

(Thousand barrels and thousand dollars)

Year	Production	Shipments		Year	Production	Shipments	
		Quantity	Value			Quantity	Value
1953–57 (average)	9,079	8,960	$24,558	1960	7,996	7,877	$25,194
1958	9,244	9,298	28,843	1961	8,329	8,028	25,605
1959	10,177	10,056	30,889	1962	8,235	8,058	25,134

TABLE 19.—Shipments of portland cement to Kansas consumers

Year	Kansas (thousand barrels)	Change, percent		Year	Kansas (thousand barrels)	Change, percent	
		In Kansas	In United States			In Kansas	In United States
1953–57 (average)	6,316			1960	5,070	−26	−7
1958	6,397	+28	+6	1961	5,770	+14	+3
1959	6,889	+8	+9	1962	5,331	−8	+3

Clays.—Output of clay and shale was 6 percent lower in volume than in 1961. Total producton was valued in excess of $1 million for the seventh consecutive year.

The clay was utilized in the manufacture of heavy clay products for the construction industry; reduced production resulted from replacement of clay products with competitive building material. Kansas Business News reported brick production in Kansas at 114 million units, a substantial decrease from 121 million units produced in 1961.[12]

Production of shale approximated that of last year. Principal uses were for lightweight aggregate, heavy clay products, and as an additive for cement. Increased use of shale for making lightweight aggregate was reported; output comprised 19 percent of total shale output, an increase of about 3 percent. The cement industry consumed 45 percent of the clay and shale produced in Kansas.

Gypsum.—Gypsum deposits were mined in two counties—Barber and Marshall. Production closely paralleled the building industry; the increased output resulted from a general rise in building construction.

Kansas crude gypsum is utilized as a retarder in portland cement. Other significant uses include soil conditioner, mild abrasives, filler in paint and paper, and as a base in insecticides.

Almost two-thirds of Kansas' output of crude gypsum is calcined; that is, heated until most of the mineral's contained water is driven off. Value of the resulting product (plaster of paris) is increased immensely. It is used in manufacturing specialized products such as wall plaster, Keene's cement, and wallboard.

[12] University of Kansas, Center of Research for Business. Kansas Business News. V. 16, No. 2, 1962.

TABLE 20.—Clays sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	836	$1,032	1960	894	$1,224
1958	875	1,145	1961	954	1,225
1959	1,021	1,271	1962	895	1,091

Pumice.—Only two deposits of pumicite (volcanic ash) were mined in Kansas. Prior to the close of World War I, Kansas ranked first for many years in the production of volcanic ash. Technology in the mid-1940's produced substitute materials resulting in a significant reduction in production and consumption of the mineral. It was estimated that more than 20 million tons of volcanic ash reserves exist in Kansas. Recent research in the laboratories of the Kansas Geological Survey indicated that the mineral can be used in filtration, insulation, and as an additive in plaster mixtures and concrete aggregate.[13]

Salt.—Total production of salt (evaporated and rock) increased 3 percent in quantity and 2 percent in value. Commercial salt was produced by six companies; one produced rock salt, three produced evaporated salt, and two produced both rock and evaporated salt. Salt ranked sixth in value among mineral commodities produced in the State.

Kansas salt was used by feed dealers, meat packers, and canners. Large amounts also were utilized by the highway departments for snow and ice removal and road stabilization.

TABLE 21.—Salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Evaporated salt		Rock salt		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	414	$6,143	529	$2,499	943	$8,642
1958	373	7,962	[1] 700	[1] 3,386	1,073	11,348
1959	389	9,035	[1] 734	[1] 4,635	1,123	13,670
1960	402	9,358	[1] 811	[1] 4,751	1,213	14,109
1961	411	9,180	502	2,229	[2] 913	[2] 11,409
1962	432	9,446	512	2,208	[2] 944	[2] 11,654

[1] Brine included with rock salt (previously included with evaporated salt) to avoid disclosing individual compny aconfidential data.
[2] Excludes brine.

Although the Nation's consumption of salt is rising due to population increases and expanding chemical, agricultural, and industrial markets, the State share of the market is expected to decrease because of high transportation costs to midwestern markets. For example, salt mined in Louisiana can be shipped by barge in the Mississippi River to markets in the midcontinent areas and compete with Kansas

[13] Bauleke, Maynard P. What's New In Volcanic Ash for Industry? Kansas Geol. Surv. Bull. 157, pt. 3, 1962, 22 pp.

salt that is transported shorter distances by rail. Furthermore, major salt producers in the Great Lakes region also have the advantage of cheaper water transportation to market centers heretofore supplied by Kansas salt producers.

Frontier Chemical Co. recovered salt from brine wells in Sedgwick County to manufacture chlorine, caustic soda, and salt.

The Atomic Energy Commission was investigating the feasibility of disposing of nuclear waste in natural salt formations. A portion of Carey Salt Co. mine, inactive since 1947, near Lyons was utilized for the test.

A section of the Carey Salt Co. mine near Hutchinson was used for industrial storage by Underground Vault and Storage Co., Inc.

Sand and Gravel.—Total sand and gravel production increased 2 percent in volume and 3 percent in value. A high level of activity in heavy construction during 1962 accounted for the increased output.[14] Almost all the sand and gravel produced in Kansas was used locally because of its low unit value.

Commercially produced sand and gravel totaled 9.3 million tons valued at $7 million, which was mined by 139 operators in 52 counties. Ninety-one percent of the production was transported by trucks and 9 percent by railroad. Sand comprised 80 percent of total commercial production; gravel accounted for the remaining 20 percent. Commercially produced sand was used largely for building, paving, fill, engine sand, railroad ballast, filtration, and sand blasting. The principal uses for commercially produced gravel were paving, building, and fill.

Government-and-contractor operations produced sand and gravel totaling 2.3 million tons valued at $1 million and used chiefly for building, paving, and fill. Sixty-eight operators in 53 counties were active in 1962.

TABLE 22.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	8,471	$6,102	1,864	$692	10,335	$6,794
1958	8,282	5,806	2,035	963	10,317	6,769
1959	9,257	6,661	2,077	1,276	11,334	7,937
1960	8,178	6,148	1,532	660	9,710	6,808
1961	8,975	6,722	2,391	1,059	11,366	7,781
1962	9,274	6,953	2,278	1,086	11,552	8,039

Stone.—Total stone production, paralleling the rise in Kansas construction activity, gained 11 percent in quantity and 6 percent in value. Stone ranked fourth in value among mineral commodities produced in Kansas. A total of 49 counties reported producing limestone, sandstone, and miscellaneous stone, 2 more than last year.

[14] Work cited in footnote 4.

TABLE 23.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,224	$2,364	3,221	$2,364
Paving	3,466	2,695	3,264	2,495
Fill	682	378	893	440
Other [1]	177	142	94	117
Total	7,549	5,579	7,472	5,416
Gravel:				
Building	155	129	270	223
Paving	1,192	932	1,356	1,150
Fill	25	16	69	76
Other [2]	54	66	107	88
Total	1,426	1,143	1,802	1,537
Total sand and gravel	8,975	6,722	9,274	6,953
Government-and-contractor operations:				
Sand:				
Paving	1,342	600	1,167	509
Fill			24	14
Total	1,342	600	1,191	523
Gravel:				
Building	43	16		
Paving	993	438	1,087	563
Fill	13	5		
Total	1,049	459	1,087	563
Total sand and gravel	2,391	1,059	2,278	1,086
Grand total	11,366	7,781	11,552	8,039

[1] Includes filtering, and other construction and industrial sand.
[2] Includes railroad ballast (1961) and miscellaneous gravel.

Limestone accounted for 94 percent of the total stone output. Dimension limestone was prepared for building stone, curbing, and flagging from nine quarries in nine counties. Crushed limestone valued at $17 million was used principally for aglime (agricultural limestone), concrete aggregate, railroad ballast, riprap, and roadstone. The cement industry consumed over 2 million tons of limestone valued at $2.3 million, or 16 percent of the output of limestone.

Sandstone was mined mainly in Lincoln County; smaller amounts were produced in Atchison, Bourbon, Neosho, and Norton Counties. Federal- and State-financed construction projects utilized large amounts of riprap and roadstone and accounted for the increased production.

Water.—Water is an important mineral commodity, and as such, continues to have a profound effect on the economic development of Kansas. Water is unique in comparison with other minerals because of its migratory and renewable characteristics. Furthermore, economic value cannot be readily measured from a value added approach. Water requirements were increasing rapidly due to expansion of industry and growth in population. Mineral industries utilize water for cooling, processing, boiler feed, and sanitary and service purposes.

TABLE 24.—Sand and gravel production in 1962, by counties

County	Short tons	Value	County	Short tons	Value
Anderson	24,300	$9,720	McPherson	47,439	$18,976
Atchison	17,500	10,000	Marshall	289,054	273,806
Barber	17,547	12,612	Mitchell	63,081	28,050
Barton	359,781	265,188	Nemaha	39,986	43,533
Chase	35,741	28,376	Ness	138,393	55,357
Cheyenne	37,322	31,574	Norton	24,348	8,094
Clark	35,591	14,236	Osage	1,067	427
Clay	189,288	168,977	Osborne	35,000	14,000
Cloud	180,513	145,880	Pawnee	134,374	82,694
Coffey	10,617	4,247	Phillips	14,417	5,767
Comanche	19,442	7,777	Pottawatomie	38,971	31,176
Cowley	381,065	269,563	Pratt	109,566	49,774
Decatur	42,709	19,270	Rawlins	3,375	2,531
Doniphan	5,257	2,103	Reno	317,128	188,481
Edwards	30,695	16,555	Rice	356,240	192,960
Elk	14,982	5,993	Russell	53,000	39,750
Ellsworth	25,094	9,878	Saline	515,898	427,084
Ford	182,108	109,484	Scott	11,614	7,185
Franklin	18,417	10,524	Sedgwick	1,335,583	794,650
Gove	161,424	113,530	Shawnee	635,100	428,335
Grant	56,000	28,000	Sherman	35,168	16,398
Gray	97,676	55,746	Smith	28,600	11,440
Greeley	18,225	7,290	Thomas	29,682	35,023
Greenwood	10,753	4,301	Trego	16,820	10,041
Hamilton	30,988	14,293	Wabaunsee	7,000	3,500
Harper	153,565	102,326	Washington	123,807	78,479
Haskell	29,220	20,088	Wichita	36,450	14,580
Hodgeman	101,970	40,788	Wilson	6,750	5,000
Jackson	105,250	45,100	Wyandotte	2,057,166	1,638,363
Kearny	107,276	67,000	Other counties [1]	2,232,178	1,633,958
Kiowa	101,548	54,659			
Leavenworth	26,725	26,190	Total	11,552,282	8,038,798
Lyon	186,438	177,818			

[1] Includes Butler, Douglas, Ellis, Finney, Geary, Harvey, Johnson, Kingman, Morris, Republic, Riley, Stafford, and Sumner Counties, combined to avoid disclosing individual company confidential data.

TABLE 25.—Stone sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Limestone [1]		Miscellaneous stone		Total stone	
	Quantity	Value	Quantity	Value	Quantity	Value
1958	11,495	$14,653	929	$383	[2] 12,424	[2] $15,036
1959	13,367	16,883	632	225	[2] 13,999	[2] 17,108
1960	11,446	14,899	[3] 368	[3] 132	[4] 11,814	[4] 15,031
1961	11,948	16,242	[3] 380	[3] 169	[4] 12,328	[4] 16,411
1962	13,098	17,106	[3] 429	[3] 168	[4] 13,527	[4] 17,274

[1] Includes diatomaceous marl, limestone for cement, and limestone for lime (1961 and 1962).
[2] Excludes sandstone.
[3] Includes dimension sandstone.
[4] Excludes crushed sandstone.

The Kansas Water Resources Board was taking an active part in the conservation and development of the State's water resources. Research conducted in cooperation with Federal agencies resulted in the publication of several documents during the year.[15] One publication presented a series of storage requirement curves for 113 stream-gaging sites in or adjoining Kansas, showing how much gross yield can be sustained in Kansas rivers with varying sizes of storage res-

[15] A Program of Fluvial Sediment Investigation in Kansas. Bull. 6, July 1961.
State Water Plan Studies Series, Part A, Preliminary Appraisal of Kansas Water Problems. Sec. 10, 11, and 12. 1962.
Kansas Streamflow Characteristics, Storage Requirements to Sustain Gross Reservoir Outflow. Tech. Rept. 4, April 1962.

ervoirs; another investigated sediments in Kansas streams and reported that suspended sediment concentration for streams in the southeast one-fourth of the State generally is lower than those for streams in the rest of the State.

Studies of flood control authorized by the Flood Control Act resulted in construction of a number of reservoirs and other water-protective projects by the Federal Government. Appropriations for 21 projects authorized by Congress amounted to $55.5 million, an increase of $15 million over the previous fiscal year. Soil Conservation Service received $2.2 million from appropriations of the Department of Agriculture for construction and planning of watershed projects in the State.

TABLE 26.—Stone sold or used by producers, by kinds and uses

(Short tons)

Use	1961		1962	
	Quantity	Value	Quantity	Value
Limestone:[1]				
Riprap	608,903	$769,704	843,247	$882,473
Concrete aggregate and road metal	8,240,175	11,414,813	9,210,465	12,250,667
Agriculture	437,803	718,186	404,422	645,663
Cement	2,134,460	2,266,451	2,163,164	2,275,033
Dimension	11,269	140,966	9,642	130,805
Other[2]	515,133	931,805	467,183	921,941
Total limestone	11,947,743	16,241,925	13,098,123	17,106,582
Sandstone:				
Crushed	(3)	(3)	(3)	(3)
Dimension	425	8,207	654	10,157
Miscellaneous stone	379,446	160,718	428,401	157,686
Total stone[4]	12,327,614	16,410,850	13,527,178	17,274,425

[1] Includes diatomaceous marl.
[2] Includes railroad ballast, cement rock, asphalt filler, coal dust, lime, mineral food, whiting, and other filler.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Excludes crushed sandstone.

METALS

The lead and zinc deposits of Kansas occur in the Tri-State District, which encompasses an area of about 2,000 square miles in southeastern Kansas, southwestern Missouri, and northeastern Oklahoma. The principal mineral mined is sphalerite with lesser amounts of galena. Germanium and cadmium minerals are associated with the Tri-State ores and recovered as a byproduct in smelting and refining operations.

For many years, the metal mining industry was an important segment of the Kansas economy. A total in excess of $200 million worth of lead and zinc metal has been mined during the past 20 years. Peak production was attained in 1926 when 126,307 tons of zinc ore and 28,463 tons of lead ore were produced; combined value totaled $23.5 million. However, due to imports of foreign lead-zinc ores, weak prices, and low-grade reserves, production has declined steadily and currently represents only a very small part of the mineral wealth of the State. Further details on the Tri-State District are given in the Oklahoma chapter.

TABLE 27.—Mine production of lead and zinc, in terms of concentrate and recoverable metals [1]

Year	Mines producing	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content [2]			
						Lead		Zinc	
		Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1953–57 (average)	------	6,597	$1,183	40,229	$3,137	4,954	$1,447	21,352	$5,204
1958	25	1,828	242	8,210	499	1,299	304	4,421	902
1959	11	702	93	1,971	149	481	111	1,017	234
1960	4	1,411	129	4,162	314	781	183	2,117	546
1961	9	1,910	222	4,730	311	1,449	298	2,446	563
1962	10	1,290	138	7,237	493	970	178	3,943	907

[1] Based on Kansas ore and old tailing treated at mills during calendar year indicated.
[2] In calculating metal content of the ores from assays, allowance made for smelting losses of both lead and zinc. In comparing values of concentrate (ore) and metal, value given for concentrate is that actually received by producer, whereas value of lead and zinc is calculated from average price for all grades.

Major lead-zinc mines remained idle during the year, but 10 small independent mine operators reported producing 124,533 tons of ore in Cherokee County, an increase of more than 24 percent over 1961. The increased production was due to the Government's price stabilization program.

The Eagle-Picher Co. produced lead pigments and sulfuric acid at its lead smelter and acid plant near Galena. Feedstock for the smelter came from captive mines and independent producers in the Tri-State District and southern Illinois.

Lead.—Despite a Government stabilization program on lead metal, average price per ton at the smelter decreased for the second consecutive year. The price drop was principally due to a loss of lead smelting facilities in the area. Remaining smelting and marketing channels resulted in higher transportation charges which were deducted from the market price. Output of lead concentrate decreased 620 tons from that of 1961.

Zinc.—Output of recoverable zinc metal increased more than 60 percent in quantity. Average price of zinc metal was 11.5 cents per pound, the same as in 1961. Kansas lead and zinc ores were concentrated at two custom mills, the Central mill of The Eagle-Picher Co. and the Robinson mill of Henderson-Tucker Mining Co.

REVIEW BY COUNTIES

Mineral production was reported in 103 of the 105 counties, 1 more than in 1961. No mineral production was reported in Brown and Ottawa Counties. Petroleum, natural gas, or both were produced in 82 counties, 1 more than in 1961. Forty-nine counties produced stone; value of stone output in 10 of the counties exceeded $500,000. Clay and/or sand and gravel were mined in 80 counties.

TABLE 28.—Value of mineral production in Kansas, by counties[1]

County	1961[2]	1962	Minerals produced in 1962 in order of value
Allen	$12,119,353	$12,556,729	Cement, petroleum, stone, clays, natural gas.
Anderson	1,278,875	1,273,244	Petroleum, stone, sand and gravel.
Atchison	296,529	(3)	Stone, sand and gravel.
Barber	10,598,212	8,766,203	Natural gas, petroleum, gypsum, natural gas liquids, sand and gravel.
Barton	29,418,008	27,824,237	Petroleum, sand and gravel, natural gas, salt.
Bourbon	671,023	790,241	Stone, petroleum, cement, coal.
Butler	22,516,548	21,198,603	Petroleum, stone, sand and gravel.
Chase	379,807	316,077	Petroleum, stone, sand and gravel, natural gas.
Chautauqua	2,516,157	2,369,206	Petroleum, natural gas.
Cherokee	3,679,668	4,160,925	Coal, zinc, lead, stone, clays.
Cheyenne	50,669	52,830	Sand and gravel, petroleum.
Clark	1,717,853	1,689,865	Natural gas, petroleum, sand and gravel.
Clay	159,444	232,486	Sand and gravel, stone, petroleum.
Cloud	(3)	332,213	Clays, sand and gravel, stone.
Coffey	552,581	678,653	Stone, petroleum, coal, sand and gravel, natural gas.
Comanche	481,002	828,983	Natural gas, petroleum, sand and gravel.
Cowley	12,190,158	13,361,074	Petroleum, natural gas, sand and gravel, stone.
Crawford	785,744	(3)	Coal, petroleum, clays, natural gas.
Decatur	1,308,541	1,476,952	Petroleum, sand and gravel.
Dickinson	805,161	697,927	Stone, petroleum.
Doniphan	485,740	487,297	Stone, sand and gravel.
Douglas	356,597	306,413	Petroleum, sand and gravel, stone.
Edwards	2,210,075	2,036,422	Petroleum, natural gas, sand and gravel.
Elk	1,698,558	1,240,949	Stone, petroleum, natural gas, sand and gravel.
Ellis	29,660,153	28,935,818	Petroleum, stone, sand and gravel.
Ellsworth	5,693,967	5,479,368	Petroleum, salt, clays, sand and gravel, natural gas.
Finney	8,040,934	12,402,844	Natural gas, petroleum, natural gas liquids, sand and gravel.
Ford	262,196	499,245	Natural gas liquids, sand and gravel, petroleum, natural gas.
Franklin	1,306,317	1,151,156	Petroleum, clays, stone, sand and gravel.
Geary	592,150	728,387	Stone, sand and gravel, petroleum.
Gove	539,933	294,511	Petroleum, sand and gravel.
Graham	16,882,482	15,866,274	Petroleum.
Grant	17,089,302	19,065,862	Natural gas, natural gas liquids, petroleum, sand and gravel.
Gray	34,810	55,746	Sand and gravel.
Greeley	13,950	7,290	Do.
Greenwood	12,003,913	10,701,898	Petroleum, stone, sand and gravel, natural gas.
Hamilton	617,898	188,138	Natural gas, petroleum, sand and gravel.
Harper	4,356,743	3,579,857	Petroleum, natural gas, sand and gravel.
Harvey	1,747,514	1,842,757	Do.
Haskell	13,088,086	10,794,474	Petroleum, natural gas, natural gas liquids, sand and gravel.
Hodgeman	1,589,443	2,683,698	Petroleum, sand and gravel.
Jackson	109,687	(3)	Stone, sand and gravel.
Jefferson	(3)	(3)	Stone.
Jewell	(3)	(3)	Do.
Johnson	247,147	640,484	Stone, sand and gravel, petroleum, natural gas.
Kearny	9,229,529	8,991,609	Natural gas, natural gas liquids, petroleum, sand and gravel.
Kingman	14,035,171	17,086,630	Petroleum, natural gas, natural gas liquids, sand and gravel.
Kiowa	3,361,688	3,050,377	Petroleum, natural gas, sand and gravel.
Labette	494,273	407,753	Petroleum, stone, natural gas.
Lane	46,423	144,765	Petroleum.
Leavenworth	605,698	429,946	Stone, lime, sand and gravel, natural gas.
Lincoln	(3)	(3)	Stone, pumice.
Linn	345,693	347,568	Stone, petroleum, natural gas.
Logan	20,416	3,494	Petroleum.
Lyon	529,093	493,815	Petroleum, sand and gravel, stone.
Marion	10,454,498	9,796,807	Petroleum, natural gas liquids, natural gas, stone.
Marshall	713,842	852,404	Gypsum, sand and gravel, stone.
McPherson	8,900,429	9,464,756	Petroleum, clays, natural gas, sand and gravel.
Meade	4,799,836	4,183,571	Petroleum, natural gas.
Miami	1,108,542	1,238,822	Petroleum, stone, natural gas.
Mitchell	6.655	(3)	Sand and gravel, stone.
Montgomery	5,020,901	5,333,288	Cement, petroleum, stone, clays, natural gas.
Morris	1,630,308	1,551,016	Petroleum, natural gas, stone, sand and gravel.
Morton	14,409,363	15,389,553	Natural gas, petroleum.
Nemaha	23,545	64,151	Sand and gravel, petroleum.
Neosho	8,442,288	7,443,462	Cement, petroleum, stone, clays, natural gas.
Ness	1,769,457	2,193,296	Petroleum, sand and gravel.
Norton	2,461,904	2,324,499	Petroleum, stone, sand and gravel, pumice.
Osage	46,589	18,884	Coal, sand and gravel.
Osborne	191,450	183,214	Petroleum, sand and gravel.

See footnotes at end of table.

TABLE 28.—Value of mineral production in Kansas, by counties[1]—Continued

County	1961[2]	1962	Minerals produced in 1962 in order of value
Pawnee	$3,682,109	$3,489,391	Petroleum, natural gas, sand and gravel.
Phillips	5,965,207	6,348,186	Petroleum, stone, sand and gravel.
Pottawatomie	139,840	136,144	Stone, sand and gravel.
Pratt	4,712,675	4,930,663	Petroleum, natural gas, sand and gravel.
Rawlins	2,197,652	2,220,608	Petroleum, stone, sand and gravel.
Reno	11,540,588	12,046,411	Salt, petroleum, natural gas, sand and gravel.
Republic	(3)	(3)	Sand and gravel.
Rice	14,389,192	15,389,115	Petroleum, salt, sand and gravel, stone, natural gas.
Riley	846,845	1,052,319	Petroleum, stone, sand and gravel.
Rooks	16,035,501	15,053,811	Petroleum.
Rush	1,396,845	2,764,075	Helium, petroleum, natural gas.
Russell	23,606,290	23,341,727	Petroleum, natural gas, sand and gravel, stone.
Saline	2,768,230	2,741,196	Petroleum, sand and gravel.
Scott	215,276	191,977	Do.
Sedgwick	11,047,786	11,677,350	Petroleum, natural gas liquids, salt, sand and gravel, stone.
Seward	6,591,805	10,189,871	Natural gas, petroleum, natural gas liquids.
Shawnee	908,029	(3)	Stone, sand and gravel.
Sheridan	857,996	780,501	Petroleum.
Sherman	283,313	198,893	Petroleum, sand and gravel.
Smith	16,746	22,600	Sand and gravel, stone.
Stafford	17,646,228	17,562,444	Petroleum, natural gas, sand and gravel.
Stanton	2,939,981	2,603,659	Natural gas, petroleum.
Stevens	15,854,222	19,048,186	Do.
Sumner	9,261,088	8,916,713	Petroleum, natural gas, sand and gravel.
Thomas	94,929	35,023	Sand and gravel.
Trego	4,523,758	4,622,172	Petroleum, sand and gravel.
Wabaunsee	851,446	852,021	Petroleum, stone, sand and gravel.
Wallace	70,255	(3)	Stone.
Washington	149,000	78,479	Sand and gravel.
Wichita	----------	18,651	Sand and gravel, petroleum.
Wilson	5,947,129	5,779,533	Cement, petroleum, stone, clays, natural gas, sand and gravel.
Woodson	2,381,813	2,469,383	Petroleum, stone, natural gas.
Wyandotte	7,808,596	8,508,337	Cement, stone, sand and gravel, clays.
Undistributed	5,067,111	9,417,545	
Total	488,598,000	501,076,000	

[1] Brown and Ottawa Counties are not listed because no production was reported in 1961 or 1962.
[2] Revised figures.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

The counties that contributed the greatest value of mineral production were those with oil and gas resources. The five principal mineral producing counties were Ellis, Barton, Russell, Butler, and Grant; these counties accounted for about 24 percent of the mineral production value in the State. A total of 58 counties reported a mineral production value exceeding $1 million, 2 more than in 1961. Allen County was the leading producer of nonfuel commodities. Only selected counties with significant mineral developments are discussed in the following review.

Allen.—Allen County ranked first in output of masonry and portland cement and first in quantity and value of clay used for cement. Lehigh Portland Cement Co. and Monarch Cement Co. manufactured cement. Humboldt Brick & Tile Co. used miscellaneous clay to produce heavy clay products. Limestone was quarried and crushed for cement, concrete aggregate, roadstone, and aglime by Lehigh Portland Cement Co., Monarch Cement Co., Nelson Bros. Quarries, and Reno Construction Co. Yield of crude petroleum was 947,000 barrels, a decrease of 2 percent from that of 1961; more than half of the production was from secondary recovery operations. The Humboldt-Chanute field secondary recovery projects were the most prolific, supplying more than one-third of the total crude production. Output of

natural gas approximated that of last year. Production came from 70 gas wells, all producing from the Bartlesville sandstone of Pennsylvanian age.

Anderson.—Output of crude petroleum from eight fields approximated that of last year; secondary recovery projects accounted for most of the production. Gravel for paving and road maintenance was produced by the county highway department. Hunt Rock Co. and Murray Limestone Co. mined and crushed limestone for concrete aggregate, roadstone, and aglime. Construction of the $21 million Garnett Dam and Reservoir was authorized under the Flood Control Act of 1962. The earthfill dam will be 3,500 feet in length, rising to a maximum height of 73 feet above the streambed.

Barber.—The county ranked first in quantity and value of gypsum production. National Gypsum Co. mined and processed gypsum at Medicine Lodge. The county ranked eighth in output of natural gas, although production declined 21 percent from 1961. Approximately 386 wells in 31 gasfields produced more than 38.5 billion cubic feet. Brooks gasfield was the most important discovery. More than 1 million barrels of crude oil was produced, a decrease of 14 percent from 1961. Approximately 558 oil wells were producing from 54 oilfields. Exploratory drilling resulted in the discovery of four new oilfields; Mingona was the most important. Natural gas liquids were recovered at the Medicine Lodge plant of Skelly Oil Co. The county highway department, Whitfield & Son, and Burl Gaunt produced sand and gravel for building, fill, and road maintenance.

Barton.—The county ranked second in value of mineral production. More than 9 million barrels of crude oil was produced, a decline of 6 percent. Approximately 164 fields were active in the county; Chase-Silica oilfield was the largest producer. A total of 191 wells drilled resulted in 92 oil, 2 gas, and 97 dry holes. Nuss South oilfield was the most important discovery; 10 oil wells produced from the Kansas City sandstone of Pennsylvanian age. Natural gas production increased 22 percent over that of 1961. Pawnee Salt Co. produced evaporated salt at Great Bend. Kansas Brick & Tile Co. used fire clay for manufacturing building brick, drain tile, and sewer pipe. Arkansas Sand Co., county highway department, Du Bois Stone & Sand Co., James Dirks Sand & Gravel, and Klepper Sand Co. dredged sand for paving, building, fill, and road maintenance.

Bourbon.—Yield of crude petroleum was almost 100,000 barrels, an increase of 70 percent over 1961. Hepler field was the most active, producing more than 60 percent of the county's total output. Garrett Coal Co. operated a strip mine near Garland. Fort Scott Hydraulic Cement Co., Inc., manufactured natural cement near Fort Scott. Dimension stone was mined by Bandera Stone Co. near Redfield. Cullor Limestone Co., Inc., and Ft. Scott Hydraulic Cement Co., Inc., quarried and crushed limestone for cement, concrete aggregate, roadstone, and aglime.

Butler.—The county ranked fourth in value of petroleum production, although output declined 6 percent from that of 1961. Approximately 3,135 oil wells were active, 42 less than during the preceding year. Secondary recovery operations accounted for more than half of the crude oil production. Wells drilled in the county totaled 162

and resulted in discovery of 2 oilfields; Overstreet oilfield was the most important discovery and produced from Kansas City sandstone of Pennsylvanian age. Skelly Oil Co. was constructing a multimillion dollar aromatic complex adjacent to its refinery near El Dorado. Texas Emulsion, Inc., Kansas' first emulsified asphalt manufacturing plant, began production near El Dorado. The company processes asphalt purchased from oil refineries in the vicinity.

Two large waterflood projects were being developed—one by Home-Stake Production Co. and the other by Cities Service Oil Co. Home-Stake's project encompasses approximately 1,300 acres and embraces most of the Keighley pool. Development of the secondary recovery operation required 30 new water injection wells, 26 new oil wells, and utilization of 8 existing wells. The Cities Service project encompasses 930 acres in the El Dorado field. Development of this project will require drilling 50 wells; of these, 28 will be water input wells.

Mobil Oil Co. built the largest oil storage tank in Kansas near Augusta; capacity is 216,700 barrels of oil.

Chase.—Yield of crude oil was 86,533 barrels, 24 percent less than in 1961. Secondary recovery operations in the Teeter field accounted for about 70 percent of the county's production. Approximately 53 wells reported producing oil, mostly from the Bartlesville sandstone of Pennsylvanian age. Output of natural gas approximated that of 1961. Dimension limestone was quarried and prepared for building stone by J. T. Lardner Cut Stone Co. The county highway department produced gravel for paving and road maintenance.

Chautauqua.—Yield of crude petroleum declined 5 percent from 1961. Secondary recovery operations accounted for a large part of the output. Approximately 2,000 wells pumped oil from 19 oilfields—the Peru-Sedan oilfield was the largest producer in the county. Marketed production of natural gas was 13 percent higher; approximately 10 wells reported gas production, mostly from sediments of Mississippian age.

Cherokee.—Cherokee County ranked first in quantity and value of coal produced; three strip mines were operated by Black Diamond Coal Co., Pittsburgh & Midway Coal Mining Co., and Wilkinson Coal Co. Pittsburgh & Midway Coal Mining Co. was assembling a huge shovel having a 90-cubic-yard bucket capacity for use at its strip mine near Hallowell. The entire production of lead and zinc in Kansas was mined in that part of the Tri-State District extending into Cherokee County. Ten small, independent mine operators mined lead and zinc ores. Miscellaneous clay was mined for manufacturing heavy clay products by United Brick & Tile Co. near Weir. Baxter Chat Co., The Eagle-Picher Co., Missouri-Kansas Development Co., and Southwest Rock & Chat Co. sold miscellaneous stone or chat, for concrete, railroad ballast, and roadstone.

Cheyenne.—Output of crude petroleum from five oilfields was 7,230 barrels, 207 barrels more than in 1961. The Rueb field was the most prolific producer and accounted for a large part of the county's production. Exploratory drilling resulted in discovery of Little Beaver Creek oilfield. Sand and gravel was produced for building, paving, and fill by the New Era Sand & Gravel Co. and the county highway department.

Clark.—Marketed production of natural gas from approximately 100 wells exceeded 10 billion cubic feet, an increase of 28 percent over 1961. Sandstone formations of the Morrowan Group of Pennsylvanian age produced most of the oil and gas in the county. Yield of crude oil from approximately 90 wells was 6 percent lower than in 1961. The Harper Ranch field was the most productive for both oil and gas. The county highway department produced sand and gravel for paving and road maintenance.

Clay.—Production of crude oil was 8,085 barrels, a decline of 21 percent from that of 1961. All the oil came from three wells in the Griffith field; a Mississippian formation was the producing zone. Alsop Sand Co., Clay Center Concrete & Sand Co., and Fyfe Sand & Gravel Co. produced sand and gravel for building, fill, paving, and road maintenance. Limestone was mined and crushed by Riddle Quarries, Inc., for concrete aggregate and roadstone.

Cloud.—The county ranked first in quantity and value of fire clay produced in Kansas. The clay was utilized by Cloud Ceramics near Concordia for manufacturing of building brick, drain tile, and sewer pipe. Beaver Sand Co., Fyfe Sand & Gravel Co., and the county commissioner produced sand and gravel for building, paving, and road maintenance. Kaneb Pipeline Co. completed its petroleum products terminal near Miltonvale. The terminal will serve a 21-county area in northern Kansas.

Coffey.—Yield of crude petroleum from 11 fields was 96,584 barrels, an increase of 4 percent over the 1961 total. The Neosho Falls-Leroy field was the most productive in the county. Approximately 224 oil wells were active, most of them producing from the Cherokee sandstones of Pennsylvanian age. Marketed natural gas production of 100,000 cubic feet from three wells was reported in 1962. Coal was produced at a strip mine near Lebo by S. L. Rogers Coal Co. The county highway department produced sand and gravel for paving and road maintenance. Nelson Bros. Quarries, Inc., and Riddle Quarries, Inc., mined and crushed limestone for aglime, concrete aggregate, and riprap. The U.S. Army Corps of Engineers worked on the embayment and spillway of the John Redmond Dam.

Comanche.—Marketed production of natural gas was almost 6 billion cubic feet, an increase of 82 percent over that of 1961. Almost all the gas production came from nine wells in the Glick gasfield. Output of crude petroleum increased significantly; production rose to 40,019 barrels, an increase of 67 percent over 1961 output. Approximately 26 wells producing from 10 oilfields reported production in 1962; most wells produced from sediments of Mississipian age. Mule Creek field furnished more than 50 percent of the county's production.

Cowley.—The county ranked 10th in quantity and value of crude oil production. Yield of petroleum exceeded 4 million barrels, an increase of 8 percent over 1961. Approximately 1,640 wells reported oil production, 4 less than in 1961. The Bartlesville sand was the most productive in the county. Marketed production of natural gas from 51 wells was more than 2.75 billion cubic feet, an increase of 36 percent over that of 1961.

Anderson-Prichard Oil Corp. constructed a Lomax unit at its refinery near Arkansas City. Seven operators produced sand and

gravel for building, engine sand, fill, and paving. Geo. M. Myers Material, Inc., purchased the sand and gravel business operated by Arkansas City Sand & Gravel Co. The entire plant was rebuilt and surface operating area increased to 200 acres. The plant is designed to produce mortar sand, concrete sand, road cover sand, sandblasting material, and engine sand. Dimension limestone was prepared by Silverdale Limestone Co. and John V. Elam. Limestone was quarried and crushed for aglime, concrete aggregate, and roadstone by C. L. Daniels Stone Co.

Crawford.—Crawford County ranked second in production of coal. Four strip mines were active; two were operated by Clemens Coal Co. and one each by Cliff Carr Coal Co. and Palmer & Sons Coal Co. Output of crude petroleum from 7 fields was 40,239 barrels, an increase of 20 percent over that of 1961. Approximately 222 wells reported oil production in 1962. More than 50 percent of the oil was obtained by secondary recovery methods. Volume of natural gas production declined 13 percent; 10 wells reported output of gas in 1962. Fire clay and miscellaneous clay were utilized to manufacture heavy clay products by W. S. Dickey Clay Manufacturing Co.

Decatur.—Yield of crude petroleum from 16 fields was more than one-half million barrels, an increase of 11 percent over that of 1961. The Adell Northwest field produced about 30 percent of the county's total oil output. A total of 42 well completions resulted in the discovery of the Unger oilfield; one oilfield was abandoned. Morton Sand & Gravel Co. started producing sand and gravel near Oberlin at year-end. The plant has a capacity of 300 cubic yards per day. The county highway department produced gravel for road maintenance.

Dickinson.—Limestone was quarried and crushed for aglime, concrete aggregate, roadstone, and riprap at seven mines; of these, five were operated by Anderson-Oxandale and the remaining by Riddle Quarries, Inc. Crude oil production from five fields was 46,396 barrels, a decline of 21 percent from 1961. More than 50 percent of the output was obtained by secondary recovery methods. Approximately 54 wells reported producing oil; most were in the Lost Springs field. The Mississippian "chat" was the most productive formation in the county.

Doniphan.—Stone and sand and gravel were the only mineral commodities produced. Everett Quarries, Inc., West Lake Quarry and Material Co., and Wolf River Limestone, Inc., quarried and crushed limestone for aglime, concrete aggregate, riprap, and roadstone. The county highway department produced stone and sand and gravel for road maintenance.

Douglas.—Yield of crude oil from two fields declined 26 percent. Secondary recovery projects in the Baldwin field accounted for most of the production. Approximately 96 wells reported producing oil in 1962; most was obtained from the Squirrel sandstone of Pennsylvanian age. Cooperative Farm Chemicals Association spent $7 million in expanding plant facilities near Lawrence. Bowersock Mills & Power Co. and Holliday Sand & Gravel Co. produced sand and gravel for building, fill, and paving. Construction of the $30 million Clinton Dam and Reservoir was approved under the Flood Control

Act of 1962. The earthfill dam will be 9,600 feet long and rise to a maximum height of about 100 feet.

Edwards.—Output of crude oil declined for the second consecutive year. Approximately 134 wells were active, most of them producing from Mississippian rocks. The Wil field produced about 90 percent of total oil output. Drilling resulted in 13 oil wells, 1 gas well, and 1 oil and gas well from 40 drilled wells. Groner oilfield was the most important discovery in the county. More than 3 billion cubic feet of natural gas was marketed, an increase of 30 percent over 1961. Gas was reported from about 126 wells. Sand and gravel was produced for building, fill, and paving by Kinsley Sand & Gravel Co. and Showalter Sand & Gravel Co.; the former expanded its business and will sell ready-mixed concrete and maintain a stock of cement.

Elk.—Elk County ranked third in crushed limestone output. Concrete Materials & Construction Co. quarried and crushed limestone for aglime, concrete aggregate, roadstone, and riprap. Gravel was produced for paving and road maintenance by the county highway department. Yield of crude petroleum from 32 oilfields declined for the second consecutive year. Some of the oilfields in Elk County are among the oldest in the State. The abandoned Preston oilfield was revived at yearend. Approximately 338 wells reported producing oil; of these 40 percent were in the Kansas City group of Pennsylvanian age. Marketed production of natural gas from about 16 wells declined 13 percent from the preceding year.

Ellis.—Ellis County ranked first in total value of mineral production. Output of crude oil was nearly 10 million barrels, a decline of 4 percent from 1961. Approximately 2,446 wells reported producing oil, 71 more than in the preceding year. The Bemis-Shutts oilfield was the most prolific producer and accounted for nearly 40 percent of the county's total output. Exploratory drilling resulted in discovery of seven new oilfields—one was combined. Antonino South was the most important discovery during the year. Lewis C. Schmidtberger produced sand for building purposes. The county highway department quarried and crushed limestone for roadstone.

Ellsworth.—The county ranked first in production of rock salt; Independent Salt Co. mined salt near Kanopolis. Yield of crude oil from 16 fields was more than 1.5 million barrels, a decline of 5 percent from that of 1961. The Geneseo-Edwards and Stoltenberg oilfields accounted for about 70 percent of the total output. Stoppel Construction Co., Walter Hoffman, and the county highway department produced sand and gravel for building, fill, paving, and road maintenance. Acme Brick Co. mined fire clay for manufacturing heavy clay products.

Finney.—Crude oil production increased significantly; increased output came from the Pleasant Prairie oilfield that heretofore was included in Haskell County oil production. Approximately 100 wells produced oil, 12 more than during the preceding year. Sedimentary rocks of the Morrowen Group, Pennsylvanian age, were the most prolific. The Finney County portion of the Hugoton gas area produced nearly 60 billion cubic feet of natural gas: the county ranked fifth in natural gas production. Output, from about 659 wells, was 11 percent higher than in 1961. Northern Natural Gas Co. recovered

natural gas liquids at its plant near Holcomb. Sand and gravel was produced for building, paving, road maintenance, and water well gravel by Sam Alsop Construction Co. and the county highway department.

Ford.—Yield of crude oil from five fields nearly doubled that of last year. The Rushville oilfield was the most important discovery in 1962; one oilfield was abandoned. Marketed production of natural gas declined 29 percent from that of 1961; output came from three wells in the Pleasant Valley gasfield. Natural gas liquids were recovered by Skelly Oil Co. at Mineola. Davis & Sons Sand Sales, Dodge City Sand Co., and Miller Sand & Gravel Co. produced sand and gravel for building, fill, and paving.

Franklin.—Crude oil production from five fields declined 12 percent. Secondary recovery methods in the Paola-Rantoul field furnished a large part of the output. Approximately 847 wells produced oil, 23 more than in the preceding year. Buildex, Inc., of Ottawa mined shale for use in making lightweight aggregate by the rotary-kiln process. The county highway department produced gravel for paving and road maintenance. Limestone was quarried and crushed for aglime, concrete aggregate, and roadstone by Fogle Rock Quarry.

Geary.—Sand and gravel was produced for building and paving by Junction City Sand & Gravel Co. and More Sand Co., Inc. Walker Cut Stone Co. quarried dimension stone for building construction; at two other quarries, limestone was mined and crushed for aglime, concrete aggregate, railroad ballast, and riprap. Peterson Equipment Co., Inc., quarried and crushed limestone for concrete aggregate and roadstone. Groundbreaking ceremonies were held in August, initiating construction of the $61 million Milford Dam and Reservoir. The multipurpose dam is located 4 miles northwest of Junction City on the Republican River. The project, supervised by the U.S. Army Corps of Engineers, was scheduled for completion in 1966. The towns of Milford and Wakefield will be inundated and will be moved.

Gove.—Output of crude oil increased to 62,411 barrels from the 16,751 barrels produced in 1961. Dave Bollinger, San Ore Construction Co., Rod Bently Sand & Gravel, and the county highway department produced sand and gravel for building, paving, and road maintenance.

Graham.—Although more than 5.4 million barrels of crude oil was produced, output declined 7 percent from 1961. The county ranked sixth in value of petroleum output. Approximately 1,227 wells produced oil, 8 less than during the previous year. Exploration during the year resulted in the discovery of six new oilfields; Riedel oilfield was the most important. The Lansing-Kansas City group of rocks of Pennsylvanian age was the most productive formation.

Grant.—The county led in natural gas liquids output, ranked second in natural gas production, and fifth in total mineral value. A total of 114.6 billion cubic feet of natural gas was produced from 611 wells in the Hugoton gasfield, an increase of 13 percent over that of 1961. Four natural gas plants were in operation; two by Pan American Petroleum and one each by Hugoton Production Co. and Socony Mobil Oil Co. The entire output of carbon black was produced by Columbian Carbon Co. at Hickok and United Carbon Co. at Ryus; the Ryus

plant was shut down at yearend. Cities Service Helex, Inc., was constructing its new helium plant, completion of which was scheduled for early 1963. Compressor capacity was increased at the Cities Service Co. pumping station near Ulysses. The county highway department produced sand and gravel for paving and road maintenance.

Greenwood.—Secondary recovery operations yielded most of the 3.7 million barrels of crude petroleum from 52 fields; production declined 12 percent. Approximately 2,540 wells produced oil, 46 more than during the preceding year. Bartlesville sandstone of Pennsylvanian age was the most productive formation in the county. Marketed production of natural gas was 9.8 million cubic feet, a considerable drop from 1961. Only one gasfield (Lane) was active. Limestone was mined and crushed for concrete aggregate and roadstone by the county highway department.

Hamilton.—Marketed production of natural gas from 37 wells in the Hugoton gasfield declined sharply to 1.2 billion cubic feet from the 4.6 billion cubic feet produced in 1961. Yield of crude oil from two wells was 9,253 barrels, 1,696 barrels less than in 1961. Morrowan sandstone of Pennsylvanian age was the most productive formation. Gravel was mined for paving and road maintenance by the county highway department.

Harper.—Oil production from 16 fields declined 24 percent. Approximately 241 wells produced oil, 4 less than during the previous year. The Lansing-Kansas City rocks of Pennsylvanian age were the most productive. Marketed production of natural gas was 5.5 billion cubic feet, an increase of 15 percent. Spivey-Grabs-Basil field accounted for most of the oil and gas production. Sand and gravel was produced for building, paving, and road maintenance by Hi-Grade Sand Co., San Ore Construction Co., Inc., and the county highway department.

Harvey.—Production of crude oil in Harvey County approximated that of last year and came mostly from Mississippian chat. Drilling activity resulted in 69 wells during the year and discovery of Annelly oilfield. Output of natural gas from 36 wells increased 42 percent over 1961; Burrton gasfield accounted for most of the production. Bryant Sand Co. produced sand and gravel for building, fill, and paving near Burrton.

Haskell.—Yield of crude oil from 10 fields declined 31 percent because production from the Pleasant Prairie oilfield was credited to Finney County. Approximately 187 wells produced oil, mostly from strata of Mississippian age. The Haskell County section of Hugoton gasfield reported 39.4 billion cubic feet of natural gas during 1962. Northern Natural Gas Co. recovered natural gas liquids at its plant near Sublette. Atchison, Topeka, & Santa Fe Railroad and the county highway department produced sand and gravel for paving, road maintenance, and railroad ballast.

Hodgeman.—Almost 1 million barrels of crude oil was produced from 20 oilfields, an increase of 65 percent. Increased production resulted from discovery of six new oilfields; Jarnagin and Lappin oilfields were the most important discoveries in the county. Approximately 112 wells produced oil, considerably more than during the preceding year. Drilling activity rose sharply and resulted in 51 oil wells and

32 dry holes. The county highway department produced sand for paving and road maintenance.

Jackson.—Geo. W. Kerford Quarry Co. and the county highway department produced gravel for paving. Limestone was mined and crushed for aglime and concrete aggregate by G. W. Baker Co. and Anderson-Oxandale.

Jefferson.—The county ranked fourth in quantity and value of stone produced. Roy Baker Quarry, Inc., N. R. Hamm Quarry, Inc., and Westhoff Lime Quarries mined and crushed limestone for aglime, concrete aggregate, and roadstone. The U.S. Army Corps of Engineers began construction of the $41 million Perry Dam and Reservoir. The damsite will be located 4 miles northwest of Perry and 8 miles above the mouth of the Delaware River.

Jewell.—The county ranked third in value of stone produced. Ideal Cement Co. mined limestone in Jewell County for use at its plant in Superior, Nebr.

Johnson.—Yield of crude petroleum from 3 fields rose to 24,254 barrels from 5,422 barrels in 1961. New wells totaled 15, of which 3 produced oil and the remainder were dry holes. Marketed production of natural gas declined 32 percent. Approximately 10 gas wells were active during the year; Gardner gasfield was the most productive. Five quarries mined and crushed limestone for aglime, concrete aggregate, and roadstone; three were operated by Reno Construction Co., the others by Deitz Hill Development Co. and Union Construction Co. Spencer Chemical Co. was conducting research to develop an economical process for fractionating Kansas coal into liquid and gaseous fuels and related byproducts. Mid-West Victorian Marble, Inc., is producing table and vanity tops from imported marblestone at its plant near Stanley; five workers are employed.

Kearny.—Kearny County ranked fourth in marketed production of natural gas. All the natural gas came from 637 wells in that portion of the Hugoton gasfield underlying the county. Exploratory drilling resulted in the discovery of one gasfield. Natural gas liquids were recovered at the Colorado Interstate Co. Lakin plant and at the Kansas-Nebraska Natural Gas Co. Deerfield plant. Output of crude oil from seven wells approximated that of last year. The Lakin field was the most productive; its two wells produced from Mississippian rocks. Sand and gravel was produced for building, paving, and road maintenance by Popejoy Sand & Gravel Co. and the county highway department.

Kingman.—The county ranked ninth in petroleum and gas production. Yield of crude oil from 31 fields was 4.4 million barrels, an increase of 22 percent. The Spivey-Grabs-Basil gas and oilfield, accounted for about 70 percent of the output. Approximately 689 wells reported producing oil, 82 more than during the preceding year. Marketed production of natural gas from about 529 wells increased 22 percent. The most important gasfield discovery was the Prather field drilled by B. H. Hilburn. Natural gas liquids were recovered at the Socony Mobil Oil Co. Spivey plant; feed came from the Spivey-Grabs-Basil gasfield.

The county ranked fourth in value and quantity of natural gas liquids recovered. Sand and gravel was produced for building, fill, and paving by Ray Wells and the county highway department.

Kiowa.—Output of crude oil from 27 fields was 602,272 barrels, a decline of 19 percent. The Nichols oilfield accounted for about 90 percent of the county's total production. Approximately 133 wells produced oil. Drilling activity in the county resulted in four field discoveries. Marketed production of natural gas increased 9 percent over that of 1961. The Einsel gasfield was the most important gas discovery in the county; its discovery well produces from rocks of Mississippian age. Sand and gravel was mined for building, paving, and road maintenance by Seacat Sand & Excavation Co. and the county highway department.

Labette.—Production of crude oil from 11 fields decreased 7 percent from 1961. Lower oil production was due to a decline in the number of secondary recovery projects in the county. Approximately 158 wells were active oil producers. Marketed production of natural gas from 40 wells approximated that of last year. Harry Keith quarried and crushed limestone for roadstone. Construction of the $5 million Big Hill Dam and Reservoir was approved under the Flood Control Act of 1962. The earthfill dam will be 3,600 feet long and rise to a height of 87 feet above the streambed.

Lane.—Yield of crude petroleum from five fields rose significantly. Increased production was due to the discovery of three oilfields, Demand, Pendennis South, and Selfridge. Although one gasfield was discovered, no natural gas was marketed.

Leavenworth.—Leavenworth County reported marketing 125 million cubic feet of natural gas from 7 wells in the Roberts-Maywood gasfield. Washed sand was produced for fill, ready-mixed concrete, and paving by Missouri Valley Sand, Inc. The limestone quarry of Loring Quarries, Inc., and the lime plant of Midwest Lime Co. were liquidated; some crushed limestone and quicklime was sold in 1962. Southeastern Public Service Co. of New York City purchased the underground storage facilities of Natural Storage Co. near Bonner Springs. The new owners planned to expand the existing facilities to more than 2 million square feet of low-temperature and dry storage space. Lawrence Ready-Mix Co. opened a branch plant in Tonganoxie to supply concrete for the local building industry.

Lincoln.—Quartzite Stone Co. produced sandstone for concrete aggregate, filter sand, railroad ballast, riprap, and roadstone. A small quantity of volcanic ash was produced by Earnest Hanzlicek. C. W. Roweth Co. quarried and crushed limestone for concrete aggregate, roadstone, and riprap.

Linn.—Waterflood projects in Linn County accounted for a large part of the crude oil produced from five oilfields; output was 13 percent below that of 1961. Approximately 361 wells produced oil. The county's only gasfield—La Cygne-Cadmus—reported production of about 50 million cubic feet of natural gas. Limestone was quarried and crushed for aglime, concrete aggregate, and roadstone by Lee Giles Rock Co. and Murray Limestone Products.

Lyon.—Petroleum production from 6 fields amounted to 102,000 barrels, a decline of 19 percent. Waterflooding operations accounted for

about half of the output. Panhandle Eastern was building a 5,000-horsepower compressor plant at its Olpe terminal. Wesley Parks and the county highway department produced sand and gravel for building and paving. Limestone was quarried and crushed for concrete aggregate and roadstone by Jones Rock Co. and Parks Sand and Gravel Co.

Marion.—Production of 2.6 million barrels of crude oil was 23 percent lower than in 1961; the drop was the direct result of a Kansas Corporation Commission shutin order in the Antelope (Lost Springs) field. Marketed production of natural gas from 215 wells was 7.7 billion cubic feet, a significant increase over that of 1961; Lost Springs gasfield supplied about 50 percent of the total output. The new gasoline plant of Round and Stewart Gasoline Co. was placed on stream at midyear. The county ranked fifth in value of natural gas liquids produced. Limestone was mined and quarried for aglime, concrete aggregate, riprap, and roadstone by Walt Keeler Co., Riddle Quarries, Inc., and Anderson-Oxandale, Inc.

Irontile of Kansas, Inc., a new industry located near Marion, manufactured a foamed asphalt concrete for use as a patching compound in street and highway maintenance. Construction of the $5 million Marion Dam and Reservoir was authorized under the Flood Control Act of 1962. The damsite is located on the Cottonwood River about 3 miles northwest of Marion.

Marshall.—Gypsum was mined and processed into plaster and plaster products near Blue Rapids by Bestwall Gypsum Co. Blue River Sand & Gravel Co., C. V. Garrett, and Heinzelman Construction Co. produced sand and gravel for building, fill, and paving. Hopper Bros. Quarry and Anderson-Oxandale quarried and crushed limestone for aglime, concrete aggregate, roadstone, and riprap.

McPherson.—Crude oil production, valued at $9.4 million, was the leading mineral produced in the county. Over 3.2 million barrels was produced from 38 fields. Secondary recovery projects accounted for about 25 percent of the output. Approximately 1,235 wells produced oil, 17 more than during the previous year. Marketed production of natural gas was more than 225.2 million cubic feet, an increase of 53 percent over that of 1961. Five wells in the Ritz-Canton gasfield supplied more than 50 percent of the output. Sand was produced for paving and road maintenance by the county highway department. Buildex, Inc., a subsidiary of Mackie Clemens Coal Co., produced lightweight aggregate at its shale expanding plant. Boettcher Supply Co. constructed an anhydrous ammonia fertilizer distribution plant near Marquette.

Meade.—Yield of crude petroleum decreased 22 percent; the loss was due in part to a drop in production in the Novinger field, the county's principal producing oilfield. Secondary recovery projects accounted for about 50 percent of the county's total output. Marketed production of natural gas was 16.6 billion cubic feet.

Miami.—Yield of crude oil from 6 fields was 302,411 barrels, a decline of 9 percent. Waterflood projects accounted for most of the production. Drilling activity in the county was concentrated in secondary recovery operations; a total of 70 well completions was reported during the year. Marketed production of natural gas was 20

million cubic feet; no production has been reported for the past 3 years. Natural gas came from 10 wells in Louisburg gasfield. Panhandle Eastern Co. was installing two 3,000-horsepower compressors at its Louisburg terminal. L. W. Hayes, Inc., and the county highway department mined and crushed limestone for aglime, concrete aggregate, riprap, and roadstone. Construction of the $12 million Hillsdale Dam and Reservoir was approved under the Flood Control Act of 1962. The damsite will be located on Big Bull Creek about 5 miles north of Paola.

Mitchell.—Harry Henery, Inc., Ed Hartmen, and Haigh Sand & Gravel Co. produced sand and gravel for building, fill, and paving. Dimension limestone was prepared for building stone by Prickett, Inc.

Montgomery.—Output of crude oil approximated that of 1961. Secondary recovery projects accounted for about 50 percent of the total production. Approximately 1,634 wells produced oil, 8 less than during the preceding year. Marketed production of natural gas from 50 wells was 350 million cubic feet, an increase of 15 percent. McDonald Oil Co. constructed a small refinery near Coffeyville to refine used lubricating oil. Cooperative Refining Co. was modernizing its refining facilities. New construction included erection of a 30-ton 79-foot-high stabilizing tower at the coking plant, improvement of light-gas recovery process, and installation of a stripper tower and a 30-horsepower gas compressor. The U.S. Army Corps of Engineers awarded a $125,000 contract to La Forge and Budd Construction Co. of Parsons for work on the Elk City Dam. Universal Atlas Cement Co. mined shale and limestone for use in masonry and portland cements. H & S Rock Co. mined and crushed limestone for aglime, concrete aggregate, and riprap.

Morris.—Yield of crude petroleum from 7 fields was 433,426 barrels, a decrease of 3 percent. The Viola limestone of Ordovician age was the most prolific formation. Approximately 76 wells produced oil, 3 more than during the previous year. Marketed production of natural gas from 12 wells declined 13 percent; Veal gasfield supplied more than 90 percent of the output. Metcalf Fill Dirt and Gravel Co. and the county highway department produced gravel for paving and road maintenance. Anderson-Oxandale and Riddle Quarries, Inc., mined and crushed limestone for aglime, concrete aggregate, riprap, and roadstone. Construction of the U.S. Army Corps of Engineer's Council Grove Dam and Reservoir was on schedule.

Morton.—Only two mineral commodities were produced in Morton County—petroleum and natural gas. Output of crude petroleum rose significantly as more than 2 million barrels was produced, an increase of 35 percent over that of 1961. Approximately 186 wells produced oil; of these 112 were in the Interstate and Taloga fields. Morton County ranked third in output of natural gas; Greenwood and Hugoton gasfields accounted for 90 percent of the production.

Neosho.—The county ranked second in production and shipment of masonry and portland cement. Ash Grove Lime and Portland Cement Co. produced sandstone, shale, and limestone for manufacture of cement. Harry Byers & Sons, Inc., and O'Brien Rock Crusher mined and crushed limestone for aglime, concrete aggregate, riprap, and roadstone. Neosho County ranked eighth in value of stone pro-

duced. Output of crude oil approximated that of last year; a large part of the oil was produced by waterflooding. Approximately 1,887 wells produced oil, 33 less than during the preceding year. The Bartlesville sandstone of Pennsylvanian age was the most prolific formation in Neosho County. Marketed production of natural gas—all from 19 wells in Leanna gasfield—was more than 121 million cubic feet, an increase of 43 percent over that of 1961.

Ness.—Petroleum and sand and gravel were the only mineral commodities produced in Ness County. Output of crude oil rose 22 percent. Increased production came from eight new oilfields; Dickman and Dumler fields were the most important discoveries during 1962. The county highway department produced sand for paving and road maintenance.

Norton.—Yield of crude oil declined 8 percent from 1961. Of 177 active wells, 88 percent were producing from Arbuckle dolomite of Ordovician age. The Bureau of Reclamation completed relocating the Rock Island Railroad and began construction of the $5.5 million Norton Reservoir in October.

Osage.—Three coal mines operated during the year, the underground mine of Bell Coal Co. and the two strip mines of Johnson Coal Co. and Graham Coal Co. Gravel was produced for paving and road maintenance by the county highway department. Diversion of 110 Mile Creek through the control works in the dam and closure of the embayment were completed on the $15 million Pomona Reservoir and Dam. Malvern Dam and Reservoir was in the preconstruction stage; the earthfill dam will be located on the upper Marias des Cygnes River, about 2 miles west of Malvern.

Osborne.—Yield of crude petroleum from 14 wells approximated that of last year. Ruggles field supplied most of the oil; its 13 wells produced from sands in the Shawnee group of Pennsylvanian age. Gravel was produced for paving and road maintenance by the county highway department. Bureau of Reclamation's $48 million Glen Elder Reservoir was in the preconstruction phase.

Pawnee.—Output of crude oil declined 6 percent. Approximately 386 wells reported producing oil, 27 less than during the preceding year. Marketed production of natural gas from 29 wells was 2.3 billion cubic feet, a decline of 3 percent. Sweeney gasfield, producing from the Arbuckle dolomite, accounted for nearly 50 percent of the total output. Johnson Sand & Gravel Co., Larned Sand & Gravel Co., and the county highway department produced sand and gravel for building, fill, paving, and road maintenance.

Phillips.—Crude oil production from 448 wells was 2.2 million barrels, an increase of 6 percent. Sands in the Lansing-Kansas City Group of Pennsylvanian age were the most prolific formations. The county highway department mined sand for paving and road maintenance. Anderson-Oxandale quarried and crushed limestone for concrete aggregate, roadstone, and riprap.

Pottawatomie.—Stone and sand and gravel were the only commodities produced. Sand and gravel was mined for building and paving by Wamego Sand Co. Dimension limestone was prepared for building construction and crushed limestone was produced for concrete aggregate and riprap by three operators at six locations; Bayer Construc-

tion Co. operated three quarries, Anderson-Oxandale, two, and Riddles Quarries, Inc., one. Construction of the $25 million Onaga Dam and Reservoir was authorized under the Flood Control Act of 1962. The damsite will be located on Vermillion Creek, about 11 miles south of Onaga.

Pratt.—Yield of crude oil from 577 wells was 1.6 million barrels, an increase of 1 percent. Carver-Robbins field was the largest producer of oil and gas in the county. Gereke Northwest oilfield was the most important discovery in the county; its two wells are producing from Viola limestone of Ordovician age. Marketed production of natural gas from 36 wells was 2.9 billion cubic feet, an increase of 52 percent. Blanche Hogard, Miller Sand & Gravel Co., Whitfield Sand & Gravel Co., and the county highway department produced sand and gravel for building, fill, paving, and road maintenance.

Rawlins.—Output of petroleum approximated that of last year; 11 fields were active. Cahoj West and Beeson oilfields were the most important discoveries during 1962; wells in both fields were producing from Lansing-Kansas City sands of Pennsylvanian age. Opal (miscellaneous stone) and sand were mined by the Atwood Sand & Rock Co. for building, fill, and paving. Anderson-Oxandale quarried and crushed limestone for concrete aggregate and roadstone.

Reno.—Reno County ranked first in both quantity and value of salt produced. Barton Salt Co. and Morton Salt Co. produced evaporated salt only, but Carey Salt Co. produced both evaporated and rock salt. Yield of crude petroleum from 32 fields was 12 percent over that of 1961. Approximately 465 wells produced oil, 14 more than during the preceding year. The Burrton field was the largest producer of oil in Reno County and accounted for about 60 percent of the output. Friendship oilfield was revived. Marketed production of natural gas from 46 wells approximated that of 1961. Huntsville gasfield was the most important discovery during the year; its discovery well was producing from rocks of Mississippian age. Cities Service Co. planned to wash out an underground storage reservoir for LP-gas products near Hutchinson, boosting its present capacity to 2 million barrels. Panhandle Eastern expanded pumping facilities at the Haven terminal by adding two 3,000-horsepower compressors. Four commercial companies and a Government-and-contractor operator produced sand and gravel for building, fill, paving, and road maintenance.

Rice.—The county ranked eighth in volume of crude oil produced; output was 4.5 million barrels, an increase of 8 percent. Approximately 1,781 wells produced oil, 71 more than during the previous year. Chase-Silica was the largest producing oilfield in the county. Drilling activity resulted in discovery of Tobias Northwest oilfield and McClintock gasfield. Marketed production of natural gas from 14 wells declined 3 percent. The county ranked second in value of salt production; American Salt Co. produced evaporated and rock salt near Lyons. Sand and gravel was produced by five commercial companies for building, fill, and paving. Limestone was mined and crushed for aglime, concrete aggregate, riprap, and roadstone by Riddle Quarries, Inc., near Little River.

Riley.—Walters Sand Co. produced sand for building and paving. Limestone was mined for concrete aggregate and roadstone at seven

locations; Bayer Construction Co. Inc., operated four quarries; Anderson-Oxandale, two; and Riddle Quarries, Inc., one. Construction of the Tuttle Creek Dam and Reservoir was completed by the U.S. Army Corps of Engineers at an estimated cost of $80 million. The reservoir's gross storage capacity is expected to be 2.4 million acre-feet; of this, 1.9 million acre-feet is allocated to flood control and the remainder to conservation and sedimentation.

Rooks.—Rooks County ranked seventh in production of crude petroleum, its only mineral resource. The Lansing-Kansas City groups of rocks of Pennsylvanian age was the most productive. Irrigation facilities adjacent to the Webster Reservoir were completed during the year by the Bureau of Reclamation.

Rush.—Output of crude oil from 23 fields was 377,055 barrels, an increase of 34 percent. Secondary recovery projects accounted for most of the production. Drilling activity resulted in discovery of a gasfield and two oilfields. Marketed production of natural gas was 1.6 billion cubic feet, an increase of 31 percent. Approximately 25 wells produced gas in the county, 12 more than during the preceding year. Lohrey gasfield and Reichel gas area were the county's largest producers. Production of helium at the Bureau of Mines plant at Otis was 41 million cubic feet, an increase of 78 percent.

Russell.—Russell County ranked third in value of mineral commodities produced. Yield of crude petroleum from 2,981 wells was more than 8 million barrels, a decline of 2 percent. Hall-Gurney and Trapp fields accounted for most of the oil and gas output of the county. Marketed production of natural gas from 22 wells was 392.4 million cubic feet, an increase of 45 percent. The county highway department produced sand for paving and road maintenance. At yearend, construction of the Wilson Dam and Reservoir by U.S. Army Corps of Engineers was nearly 30 percent complete. The damsite is located on Saline River near the Russell-Lincoln County boundary.

Saline.—Only two mineral commodities were produced in the county, petroleum and sand and gravel. Output of crude oil from 15 fields increased 11 percent; Viola limestone of Ordovician age supplied about 75 percent of the total production. The county ranked fourth in sand and gravel production. Salina Sand Co., Inc., Central Kansas Sand, Inc., and the county highway department furnished sand and gravel for building, fill, paving, sandblasting, and filtration. At yearend, General Dynamics completed a construction project consisting of 12 Atlas missile silos in the vicinity of Schilling Air Force Base, near Salina.

Scott.—Output of crude oil from 14 wells declined 6 percent. Six fields were acive, two less than during the previous year. Sand for paving and road maintenance was produced by the county highway department. Kansas-Nebraska Pipeline Co. added a 2,500-horsepower compressor plant at its Scott City terminal.

Sedgwick.—Yield of crude oil from 650 wells was 2.4 million barrels, an increase of 8 percent. More than half the county's active wells produced from the Lansing-Kansas City formation of Pennsylvanian age. The county ranked second in recovery of natural gas liquids. Cities Service Co. and Kansas Hydrocarbon Co. recovered natural gas liquids at plants near Wichita and Cheney, respectively. Northern Natural

Gas Co. constructed four large tanks to store propane and butane near Wichita. Frontier Chemical Co. pumped brine from wells to manufacture chlorine and caustic soda; output increased 4 percent. Sedgwick County ranked second in the production of sand and gravel for building and paving; Mills Sand, Inc. produced the largest tonnage. Vermiculite was exfoliated by Dodson Manufacturing Co. of Wichita; quantity and value declined from that of 1961. Crude vermiculite was purchased from Zonolite Co., Libby, Mont. At yearend, construction of the Andale Watershed Dam was nearing completion. The structure will afford flood protection for residents of Andale. Bureau of Reclamation awarded a contract in excess of $6 million to Cimarron-Williams Construction Co. for work on Cheney Reservoir and Dam. The earthfill dam will be 3.5 miles long and cross channels of North Fork of Ninnescah River.

Seward.—Yield of crude petroleum from 29 fields tripled. Increased production was due to discovery of five oilfields; the most important were Ang North and Evalyn Southeast. Producing wells rose to 138, nearly double the 72 wells reported producing in 1961. Drilling activity was concentrated in the Kismet field area where six producing zones have been developed. Marketed production of natural gas was 41.3 billion cubic feet, an increase of 37 percent. The most important producing field was the Seward County section of the Hugoton gas area. The county ranked third in recovery of natural gas liquids. Most of the natural gas produced in the county was processed by the Panhandle Eastern Pipeline Co.'s natural gasoline plant near Liberal.

Shawnee.—The county ranked third in quantity and value of sand and gravel output. Six commercial operators produced sand and gravel for building, engine sand, and paving; Kansas Sand Co., Inc., was the largest producer. H. C. Luttjohann, Inc., and Netherland Stone Co. mined and crushed limestone for concrete aggregate, riprap, railroad ballast, and roadstone. Large expenditures for road building and industrial and residential construction in the vicinity of Topeka accounted for increased construction material output in the county.

Sherman.—Output of crude petroleum declined 26 percent. Nine wells in Llanos field produced all the oil in the county. Walt Rhodes Sand and Gravel and the county highway department produced sand and gravel for building, paving, and road maintenance.

Stafford.—The county ranked fifth in crude petroleum production. Output of oil from 181 fields was 5.9 million barrels, a decline of 2 percent. Approximately 1,518 wells produced petroleum, 25 more than during the preceding year. Exploration drilling resulted in seven field discoveries (six oil and one gas). Marketed production of natural gas rose sharply for the second consecutive year; the 3.5 billion cubic feet represented a 38-percent production gain. Approximately 53 wells produced gas, 17 more than during 1961. Partin Sand and Gravel Co. and the county highway department produced sand and gravel for building, paving, and road maintenance.

Stanton.—The county ranked 10th in natural gas production. More than 85 percent of the 21.6 billion cubic feet produced came from Hugoton gasfield. Yield of crude oil was 16,397 barrels, a decrease

of about 9,000 barrels. Six fields were active in the county, four less than during 1961.

Stevens.—Stevens County ranked first in output of natural gas; 151.3 billion cubic feet marketed was an increase of 16 percent. Most of the natural gas came from the Hugoton gasfield. Exploration resulted in discovery of two gasfields, Grigsby and Kel. Output of crude oil from 23 wells rose sharply for the second consecutive year. The 399,096 barrels produced came from 12 fields, 1 more than in 1961. The number of producing wells more than doubled and was responsible for the increased production.

Sumner.—Yield of crude oil from 68 fields was 3.1 million barrels, a decrease of 4 percent. Approximately 841 wells were active, 14 less than during the preceding year. Natural gas output decreased 21 percent; Murphy gasfield was credited with most of the production. Sand and gravel was produced for building, paving, and road maintenance by Mulvane Sand Co., Inc.

Trego.—Output of crude oil was 1.6 million barrels, an increase of 4 percent. Drilling activity rose sharply and accounted for 50 well completions. Exploration resulted in discovery of three oilfields. Sand and gravel was produced for building, paving, and road maintenance by Raymond Stanton and the county highway department. Bureau of Reclamation irrigation facilities at Cedar Bluff Reservoir were completed.

Wabaunsee.—Output of crude oil, the county's leading mineral commodity, declined 5 percent. Approximately 37 wells produced oil, mostly from Viola limestone of Ordovician age. The county highway department produced sand and gravel for paving and road maintenance. Bayer Construction Co., Inc., and M. Schaefer mined and crushed limestone for concrete aggregate and roadstone.

Wallace.—National Lead Co., De Lore Division, was the only producer of diatomaceous marl in the State; the quarry was 17 miles south of Edson. Diatomaceous marl was used as paint filler and as a substitute for whiting.

Wichita.—Output of crude oil was 1,404 barrels; no production was reported in 1960 and 1961. The county's only producing oilfield (Carwood) was abandoned in 1959. Exploratory drilling in 1962 resulted in the discovery of the White Woman field. The discovery well, No. 1 Weesher, center NW¼SW¼ sec. 34, T. 20 N., R. 35 W., was drilled by Amarillo Oil Co., 17 miles southeast of Leoti. Oil was produced from the Marmaton sandstone. The county highway department mined sand for paving and road maintenance.

Wilson.—Wilson County ranked fourth in output of portland cement. General Portland Cement Co. mined shale and limestone for manufacture of masonry and portland cement at its plant near Fredonia. Miscellaneous shale was mined for the manufacture of heavy clay products by Acme Brick Co. and Excelsior Brick Co. Yield of crude oil from 10 fields was 364,809 barrels, an increase of 20 percent. Secondary recovery projects accounted for most of the crude petroleum output. Marketed production of natural gas from 41 wells was 134 million cubic feet, 25 percent over that of 1961. Bartlesville sandstone was the the only gas-producing formation in the county. Gravel was produced for paving and road maintenance by the county

highway department. Benedict Rock and Lime Co. and Carr Rock Products Co. quarried and crushed limestone for aglime, concrete aggregate, riprap, and roadstone.

Woodson.—Output of crude petroleum from 20 fields was 834,294 barrels, an increase of 7 percent. Waterflooding accounted for a large part of the production. Bartlesville sandstone of Pennsylvanian age was the most prolific formation. Most of the drilling activity was confined to field development projects. A small amount of natural gas was produced. Limestone was mined and crushed for concrete aggregate, and roadstone by Nelson Bros. Quarries.

Wyandotte.—The county ranked third in output of cement. Lone Star Cement Corp. manufactured masonry and portland cement by wet process at its plant near Bonner Springs. Wyandotte County ranked second in production of shale used for cement and first in the production of sand and gravel and crushed limestone. Seven commercial operators produced sand and gravel; Stewart Sand & Material Co. was the State's largest.

Limestone was quarried and crushed for aglime, asphalt base, concrete aggregate, and roadstone by Peerless Quarries, Inc., Thompson-Strauss Quarries, and J. A. Tobin Construction Co. Crude perlite, mined in Western States, was expanded at the Kansas City plant of Light Weight Products, Inc., for building material. Both quantity and value of perlite output decreased. Phillips Petroleum Co. began operating a new asphalt emulsion plant near Kansas City.

The Mineral Industry of Kentucky

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Kentucky for collecting information on all minerals except fuels.

By Harold L. Riley,[1] Preston McGrain,[2] and Mildred E. Rivers [3]

MINERAL production value in Kentucky in 1962 increased 4 percent but was 21 percent below that of 1948, the record year. New records were established for portland cement, miscellaneous clay, and crushed limestone. The value of coal output increased 6 percent and the total tonnage increased by 10 percent. Among the States, Kentucky ranked second in ball clay and fluorspar production and third in production of bituminous coal.

Coal mining dominated the Kentucky mineral industry and supplied 68 percent of the total value compared with 66 percent in 1961. Leading companies, based on value of production, were Peabody Coal Co., Nashville Coal Co., Pittsburg & Midway Coal Co., Bethlehem Mines, Inc., and United States Steel Corp.

TABLE 1.—Mineral production in Kentucky [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite—short tons	3,304	$30	4,097	$36
Clays [2]—thousand short tons	906	2,406	936	2,158
Coal (bituminous)—do	63,032	256,158	69,212	270,875
Fluorspar—short tons	[3] 31,169	[3] 1,420	33,830	1,492
Gem stones	[4]	[4]	[4]	[4]
Lead (recoverable content of ores, etc.)—short tons	656	135	743	137
Natural gas—million cubic feet	70,937	17,592	70,241	17,419
Petroleum (crude)—thousand 42-gallon barrels	18,344	54,482	[6] 18,122	[6] 53,460
Sand and gravel—thousand short tons	5,582	5,540	6,137	5,378
Silver (recoverable content of ores, etc.)—troy ounces	2,065	2	1,410	2
Stone—thousand short tons	17,085	23,309	19,472	27,682
Zinc (recoverable content of ores, etc.)—short tons	1,147	264	1,172	270
Value of items that cannot be disclosed: Cement, ball clay, and natural gas liquids		[3] 22,450		20,609
Total		[3] 383,788		399,518

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes ball clay, which is included with "Value of items that cannot be disclosed."
[3] Revised figure.
[4] Weight not recorded.
[5] Less than $500.
[6] Preliminary figure.

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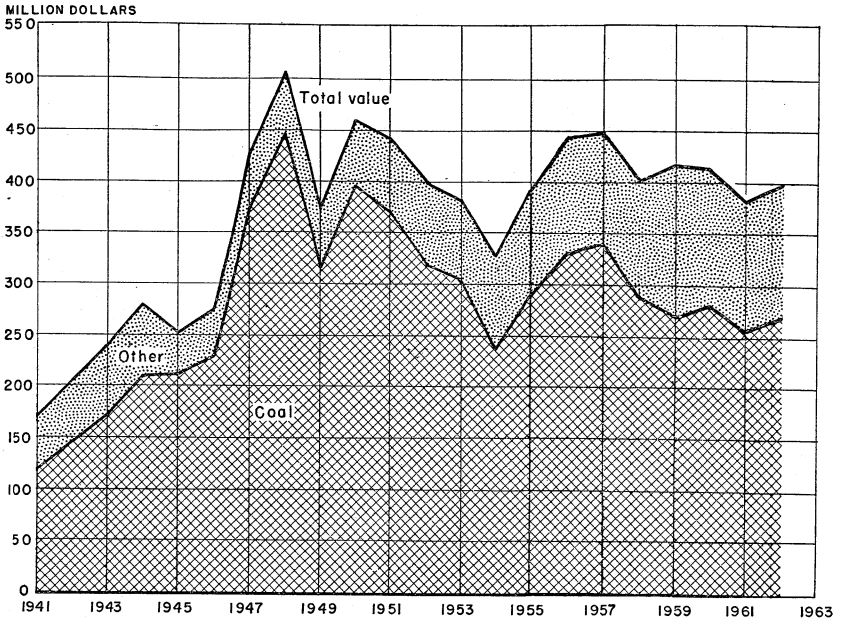

FIGURE 1.—Value of coal and total value of all minerals produced in Kentucky, 1941–62.

Employment and Injuries.—Reports submitted to the Bureau of Mines indicated that employment in mineral industries increased about 4 percent. The number of men employed at coal mines decreased by 1,048, or 4 percent.

TABLE 2.—Employment and injuries in the mineral industries

Year and industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:							
Coal mines	2,096	27,288	171	37,011,517	62	1,629	46
Oil and gas	(1)	4,740	257	9,750,471	----------	72	7
Quarries and mills	99	2,245	225	4,077,911	2	129	32
Sand and gravel mines	33	484	283	1,210,531	----------	24	20
Nonmetal mines and mills	56	555	202	897,488	----------	21	23
Coke ovens	2	(2)	(2)	(2)	----------	4	(2)
Total	(2)	(2)	(2)	(2)	64	1,879	(2)
1962: [3]							
Coal mines	1,830	26,240	183	38,432,000	42	1,385	37
Quarries and mills	115	2,322	235	4,682,298	2	134	29
Sand and gravel mines	32	361	218	912,707	1	30	34
Nonmetal mines and mills	56	440	218	778,265	1	38	50
Coke ovens	2	(2)	(2)	(2)	----------	5	(2)
Total	2,035	(2)	(2)	(2)	46	1,592	(2)

[1] Data not available.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Preliminary figures.

The safety record was considerably better. Forty-six fatalities occurred, compared with 64 in 1961, and 65 in 1960. Frequency rate decreased from 43 to 36, or 16 percent.

Trends and Developments.—Harvey Aluminum Co. announced plans to build a $50 million aluminum rolling mill near Lewisport. The 700,000-square-foot plant was expected to produce 120 million pounds of aluminum products annually. Kenlite Division of Ohio River Sand Co. increased light aggregate capacity to approximately 330,000 tons per year by constructing a rotary kiln in Bullitt County. Armco Steel Corp. awarded a $1.5 million contract for a 600-ton-per-day coal injection system to be added to a blast furnace at the Ashland plant. Air Products & Chemicals, Inc., and Armco Steel Corp. jointly announced plans for the construction and operation by Air Products of a 680-ton-per-day liquid oxygen plant at Ashland to supply liquid oxygen to the Armco steel plant. The first natural draft water-cooling tower of hyperbolic design in the Western Hemisphere and the largest in the world was constructed at the Big Sandy plant of Kentucky Power Co. near Louisa, Ky. The tower was designed to cool 173 million gallons per day of recirculated steam-condenser cooling water from 110° to 87° F when the atmosphere has a dry-bulb temperature of 80° F and an ambient wet-bulb temperature of 72° F. A large multicolored map entitled "Mineral Resources and Mineral Industries of Kentucky" was published cooperatively by the Kentucky Department of Commerce and the Kentucky Geological Survey.

The Tennessee Valley Authority awarded Kentucky Oak Mining Co. of Hazard a 15-year contract to supply 23,490,000 tons of coal for $70,470,000 or $3 per ton. Deliveries will start in April 1965 at the rate of 30,000 tons per week, most of the coal to be produced from underground mines in the Hazard area.

The two largest rotary blast-hole drills, designed to drill 15-inch-diameter blast holes 150 feet deep in 15 minutes, drilled the overburden at the Peabody Coal Co. Sinclair mine near Paradise.

Legislation and Government Programs.—Congress appropriated $77,485,000 for navigation and flood control projects in Kentucky. The Federal Geological Survey and the Kentucky Geological Survey continued to map the geology of the entire State on 7.5-minute quadrangle maps.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Production of coal increased 10 percent but was 18 percent below the 1947 record. Bituminous coal was mined at 1,934 mines in 42 counties, compared with 1,968 mines in 42 counties in 1961. Leading counties were Muhlenberg, Hopkins, Pike, and Harlan. Leading producing companies on the basis of tonnage were Peabody Coal Co., Nashville Coal Co., Pittsburg & Midway Coal Co., River Queen Coal Co., and Gibraltar Coal Co.

In the eastern Kentucky coalfield, 1,840 mines in 30 counties produced 37,157,000 tons, compared with 1,862 mines in 31 counties that

produced 32,420,000 tons in 1961. Average production per mine increased from 17,400 to 20,200 tons. Underground mines produced 84 percent, auger mines 10 percent, and strip mines 6 percent of the total. Shipments were 84 percent by rail or water and 16 percent by truck. Captive tonnage was 16 percent of the total.

TABLE 3.—Coal (bituminous) production by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Bell	1,743,406	$6,949,555	1,848,368	$7,315,288
Boyd	89,708	293.091	56,149	157,820
Breathitt	555,630	3,268.942	602,521	3,514,947
Butler	246,271	731,405	183,547	762,771
Carter	14,360	66,498	24,432	122,160
Christian	85,605	451,206	69,799	361,964
Clay	1,372.704	5,221.533	1,065,391	4,077,350
Clinton	20,362	40,724	5,301	25,285
Daviess	1,018,508	4,609,593	1,062,050	2,770,291
Elliott	15,157	60,324	15,989	54.943
Floyd	3,762,858	21,889,608	3,746,688	20,528,914
Grayson	2,240	7,370	1,600	5,568
Greenup	3,016	14,386		
Hancock			3,205	11,153
Harlan	3,739,809	19,403,439	5,528,165	28,745,732
Henderson	250,368	746,096	278,109	822,244
Hopkins	10,497,856	37,412,196	330,308	36,177,347
Jackson	69,111	280,877	27,369	136,403
Johnson	183,742	720.269	79,992	602.973
Knott	2,072.206	5,870,597	1,[illegible]8,636	6,232.009
Knox	256,047	840,682	279,893	934,546
Laurel	31,516	116,331	107,286	380,213
Lawrence	7,253	27,074	16,793	67,896
Lee	43,385	193.063	49,889	202,513
Leslie	1,679,676	7,001.562	1,805.170	6,931.853
Letcher	4,454,549	23,976,161	5,064,122	25,366,230
Magoffin	64,193	283,733	44,419	133.257
Martin	19,156	57.468	68,550	312,588
McCreary	474,592	1,793,890	360,322	1,268,606
McLean	77,991	213,575	73,638	211,545
Morgan	44,830	133,970	39,611	158,444
Muhlenberg	11,647,036	38,399,866	13,646,757	44,693,585
Ohio	3,136,378	10,401,309	3,238,664	10,721,872
Owsley	100,000	200.000	2,400	10,944
Perry	3,424,582	14,936.191	3,474,150	14,531,156
Pike	7,462,493	33,428,342	9,946,417	37,555,473
Pulaski	128,643	521,985	88,300	386,280
Rockcastle	15,452	55,332	10,000	33,020
Union	2,575,941	10,316,201	2,563,902	10,098.614
Wayne	1,748	10,242	1,800	8,118
Webster	1,073.598	3,234,457	603,298	1,641,389
Whitley	559,338	1,934,221	718,471	2,749,211
Wolfe	10,429	44,250	10,548	52,740
Total	63,031.743	256,157,614	69,212,019	270,875,255
Earliest record to date	2,774,621,000	(1)	2,843,833,000	(1)

[1] Data not available.

Equipment used at 1,681 underground mines included 1,137 cutting machines, which cut 78 percent of the tonnage; 1,771 power drills, which drilled 86 percent; 312 mobile loading machines, which loaded 49 percent of the tonnage; 46 continuous mining machines, with 15 mobile loaders used in conjunction, which produced 11 percent; 33 hand loaded conveyors upon which was loaded 1 percent; plus 816 locomotives, 592 shuttle cars, 516 shuttle buggies, and 147 mother conveyors.

Equipment used at 57 strip mines included 97 power shovels, 2 draglines, 67 bulldozers, 25 power drills, and 175 trucks.

Equipment used at 102 auger mines included 107 coal recovery augers, 16 power shovels, 1 dragline, 78 bulldozers, 6 power drills, and 113 trucks.

Of the total coal production from the eastern Kentucky field, 44 percent was cleaned at 44 cleaning plants, 22 percent was crushed and 11 percent was treated with oil.

In the western Kentucky coal field, 94 mines in 12 counties produced 32,055,000 tons, compared with 103 mines in 11 counties producing 30,612,000 tons in 1961. Average production per mine increased from 289,000 to 341,000 tons. Underground mines produced 36 percent, auger mines 1 percent, and strip mines 63 percent of the total production. Shipments were 96 percent by rail or water and 4 percent by truck. All coal was sold on the open market.

Equipment used at 48 underground mines included 96 cutting machines, which cut 99 percent of the tonnage; 103 power drills which drilled 99 percent of the tonnage; 96 mobile loading machines, which loaded 98 percent of the tonnage; 93 locomotives, 237 shuttle cars, 67 mother conveyors, and 3 continuous mining machines, which mined 1 percent of the tonnage.

Equipment used at 43 strip mines included 81 power shovels, 31 draglines, 91 bulldozers, 50 power drills, and 171 trucks. An estimated 142 million cubic yards of overburden was excavated.

Equipment used at three auger mines included three coal recovery augers, three bulldozers, and one dragline.

Thirty-two cleaning plants cleaned 77 percent of the coal produced; 44 percent was crushed, and 17 percent was treated with oil or calcium chloride.

Coke.—Two companies produced metallurgical coke at plants in Boyd and Marshall Counties. The producers were Allied Chemical Corp. and New York Mining & Manufacturing Co.

Natural Gas.—Marketed production of natural gas decreased by 1 percent and was 25 percent below the 1947 record. Of the wells drilled in 1962, 196 produced natural gas and 23 wells were used for gas storage. At yearend, 6,100 wells were estimated to be producing. Cumulative natural gas production in the State since 1883 was 2,221,000 million cubic feet. The largest source of natural gas was the Big Sandy gasfield located in the eastern part of the State. Devonian shales contributed more than two-thirds of the gas from this field. Underground storage capacity for natural gas was 18,277,000 thousand cubic feet.

Natural Gas Liquids.—*Natural Gasoline.*—Production of natural gasoline decreased 7 percent.

LP Gases—Production of liquefied-petroleum (LP) gases decreased 11 percent. Underground storage capacity for liquefied-petroleum gases was 470,000 barrels.

Petroleum.—Production of crude petroleum decreased by 1 percent and was 34 percent below the record established in 1959. At yearend, 15,324 oil wells were estimated to be producing in 61 of the 120 counties in the State. Leading producing counties were Henderson, Daviess, and Lee, compared with Henderson, Union, and Daviess in 1961.

Secondary recovery by waterflooding of old producing properties has become increasingly important in petroleum production. An estimated 58 percent of the total production was obtained from 115 waterflood projects. Waterflood wells represented approximately one-third of all the wells drilled in Kentucky.

Among the 1,772 wells drilled during the year, 551 produced oil, 196 produced gas, 23 were for gas storage, and 1,002 were dry. Rocks of the Mississippian period produce the greatest quantities of petroleum in Kentucky. Smaller quantities come from Pennsylvanian, Devonian, Silurian, and Ordovician formations. The most active exploratory drilling in 1962 occurred in the Hanson area of Hopkins County. By yearend, the new Hanson pool had 22 producing oil wells. Initial production from some wells, with depths of 2,900 feet, was reported in excess of 500 barrels per day.

NONMETALS

Barite.—J. Willis Crider Fluorspar Co. mined crude barite in Crittenden County for oil well drilling.

Cement.—Kosmos Portland Cement Co. operated the Kosmosdale plant throughout 1962. Shipments of portland cement increased 7 percent above the previous high established in 1961. Shipments of masonry cement increased by 10 percent and were less than 1 percent below the record year 1959. Raw materials used in portland cement included limestone (76 percent), miscellaneous clay (20 percent), gypsum (3 percent), and iron ore (1 percent).

Clays.—*Ball Clay.*—Kentucky ranked second in the United States in ball clay production. Kentucky-Tennessee Clay Co. and Old Hickory Clay Co. mined ball clay at three mines in Graves County for whiteware, floor and wall tile, refractories, art pottery, fillers, enameling, and other uses.

Fire Clay.—Twelve companies or individuals mined fire clay at 28 mines in 4 counties for firebrick and block, floor and wall tile, heavy clay products, and fire clay mortar. Leading producers were General Refractories Co., Davis Firebrick Co., and Harry Hatfield & Co. Leading counties were Greenup, Carter, and Rowan. Production decreased 21 percent and was 60 percent below the 1951 record. Total production was 196,000 tons valued at $1,196,000.

Miscellaneous Clay.—Fourteen companies mined miscellaneous clay at 15 mines in 10 counties for heavy clay products, lightweight aggregate, and cement. Leading counties were Bullitt, Jefferson, and Hancock. Leading producers were Kenlite Division of Kentucky Light Aggregates Inc., Kosmos Portland Cement Co., and General Shale Products Co. Production increased 12 percent above the high established in 1961. Total production was 740,000 tons valued at $962,000.

Fluorspar.—In Livingston, Crittenden, and Caldwell Counties, fluorspar was mined for use in manufacturing hydrofluoric acid, glass and steel and for use in iron foundries. Leading producers were Calvert City Chemical Co. (Dyers Hill mine) and J. Willis Crider Fluorspar Co. (Pigmy mine). Total marketable production was 32,000 tons valued at $1,452,000. Marketable production increased 4

TABLE 4.—Crude petroleum production, by counties

County	1961		1962 [1]	
	Barrels	Value	Barrels	Value
Adair	[2] 86	$255	----	----
Allen	[2] 111,187	330,225	116,231	$342,765
Barren	78,347	232,691	43,240	127,515
Bath	5,594	16,614	5,355	15,792
Bell	786	2,334	----	----
Boyd	714	2,121	580	1,710
Breathitt	181,035	537,674	111,113	327,672
Breckinridge	204,205	606,489	118,349	349,011
Butler	362,565	1,076,818	347,435	1,024,586
Casey	23,925	71,057	34,263	101,042
Christian	1,312,857	3,899,185	935,971	2,760,178
Clinton	180,422	535,853	125,064	368,814
Crittenden	89	264	163	481
Cumberland	47,740	141,788	48,419	142,788
Daviess	1,643,159	4,880,182	1,749,337	5,158,795
Edmonson	1,481	4,399	807	2,380
Elliott	79,232	235,319	64,201	189,329
Estill	117,937	350,273	178,494	526,379
Floyd	27,674	82,192	15,394	45,397
Garrard	----	----	51	150
Grayson	----	----	61	180
Green	962,909	2,859,840	466,101	1,374,532
Greenup	216	642	----	----
Hancock	320,616	952,230	255,291	752,853
Hardin	1,120	3,326	2,662	7,850
Hart	58,411	173,481	37,337	110,107
Henderson	[2] 3,334,669	9,904,285	3,825,322	11,299,094
Hopkins	58,382	173,395	270,585	797,955
Jackson	1,242	3,689	1,193	3,518
Johnson	153,051	454,561	184,591	544,359
Kenton	[3]	[3]	----	----
Knott	[2] 18,134	[2] 53,858	15,168	44,730
Knox	3,322	9,866	1,795	5,294
Laurel	1,417	4,208	1,074	3,167
Lawrence	362,396	1,076,316	408,758	1,205,427
Lee	1,522,846	4,522,853	1,709,775	5,042,126
Leslie	4,707	13,980	3,944	11,631
Letcher	12,035	35,744	9,663	28,496
Lincoln	16,209	48,141	7,820	23,061
Logan	1,331	3,953	898	2,648
Magoffin	1,094,355	3,250,234	1,021,787	3,013,250
Martin	20,714	61,521	19,937	58,794
McCreary	1,141	3,389	16,936	49,944
McLean	696,587	2,068,863	835,979	2,465,303
Meade	----	----	74	218
Menifee	----	----	517	1,525
Metcalfe	224,419	666,524	190,180	560,841
Monroe	1,079	3,205	109	322
Morgan	1,236	3,671	738	2,176
Muhlenberg	773,264	2,296,594	685,430	2,021,333
Ohio	981,708	2,915,673	940,609	2,773,856
Owsley	1,433	4,256	1,188	3,504
Perry	4,682	13,906	4,668	13,766
Pike	55,355	164,404	44,131	130,142
Powell	241,350	716,810	264,140	778,949
Rockcastle	38	113	----	----
Russell	10,583	31,432	5,429	16,010
Simpson	9,705	28,824	11,086	32,693
Taylor	248,240	737,273	10,817	31,900
Todd	10,070	29,908	7,323	21,596
Union	1,660,691	4,932,252	1,555,234	4,586,385
Warren	40,657	120,751	44,762	132,003
Wayne	44,536	132,272	26,450	78,001
Webster	941,597	2,796,543	1,283,799	3,785,923
Whitley	38,836	115,343	29,303	86,415
Wolfe	29,676	88,138	24,869	73,339
Total	[2] 18,344,000	[2] 54,482,000	18,122,000	53,460,000
Earliest record to date	[2] 435,542,000	[2] 991,566,000	453,644,000	1,045,026,000

[1] Preliminary figures.
[2] Revised figures.

Source: Kentucky Geological Survey.

percent but was 77 percent below the 1941 record. Total cumulative production from earliest records to date was 2,947,000 tons. Shipments to consumers from Kentucky were 39,000 tons valued at $1,732,000. The United States Steel Corp. shipped the stockpile at the Tabb No. 1 mine to Minerva Oil Co. in Illinois for processing.

Gem Stones.—The Majors Rocks collected mineral specimens and fossils for souvenirs. Total value reported was $120.

Gypsum.—A drill hole near Guston in Meade County and a drill hole near Summit in Hardin County encountered gypsum and anhydrite in the lower St. Louis limestone at 336 feet and 460 feet below the surface respectively. The deposit near Guston consisted of 54 feet of interbedded limestone and evaporites with gypsum and anhydrite constituting an estimated 35 percent of the interval. Near Summit, 49 feet of interbedded carbonates and evaporites contained an estimated 28 percent of gypsum and anhydrite. These stratigraphic tests were drilled as part of the Statewide geologic mapping program. These deposits were stratigraphically equivalent to deposits being mined in Indiana. Although these deposits were probably not large enough to be considered ore, further exploration may be justified.

Lime.—Air Reduction Chemical & Carbide Co. calcined sludge to produce captive and open-market byproduct lime in plants in Marshall and Jefferson Counties.

Sand and Gravel.—Twenty-two producers, including the State and county highway departments, mined sand and gravel at 32 mines in 20 counties. Leading producers were Standard Materials Corp., Ohio River Sand Co., and R. W. Green, Jr., Sand & Gravel Co. Production increased by 10 percent and was 8 percent above the 1956 record. Of the total production, 84 percent was washed. Sixty-two percent was hauled by truck, 29 percent by water, and 9 percent by rail.

TABLE 5.—Sand and gravel sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Ballard	18,138	$20,900	25,520	$12,860
Calloway	45,114	91,099	27,242	70,311
Carlisle	11,204	13,000	8,621	4,331
Fulton	83,901	96,900	16,973	15,062
Graves	52,517	60,900		
Hickman	22,263	25,800	17,946	8,973
Jefferson	2,206,389	2,253,676	2,276,294	1,957,360
Livingston	6,082	7,000	125,196	103,915
Lyon	13,220	15,340	752	376
Marion	15,000	17,000		
Marshall	26,490	30,700	25,699	12,849
Mason	72,500	113,600	84,000	134,400
Pike	5,550	6,327	4,750	4,702
Union	25,000	29,500	75,000	86,000
Undistributed [1]	2,979,125	2,758,591	3,449,365	2,967,165
Total	5,582,493	5,540,333	6,137,358	5,378,304

[1] Includes the following counties for which figures are withheld to avoid disclosing individual company confidential data: Boone, Breckinridge, Carroll (1961), Daviess, Gallatin, Henderson, Logan (1962), McCracken, and Trimble (1962).

TABLE 6.—Sand and gravel sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	2,054,777	$2,034,156	$0.99	2,114,812	$1,944,217	$0.92
Paving	1,148,959	958,521	.83	1,471,243	1,207,746	.82
Fill	236,082	161,477	.68	837,614	358,057	.43
Glass	14,000	42,000	3.00	17,085	64,100	3.75
Molding	5,000	17,500	3.50			
Other	(1)	(1)	(1)	(1)	(1)	(1)
Gravel:						
Paving	1,277,955	1,317,800	1.03	1,027,380	939,019	.91
Structural	753,077	944,492	1.25	630,130	835,591	1.33
Fill	(1)	(1)	(1)	31,212	25,039	.80
Other	(1)	(1)	(1)			
Total sand and gravel	5,582,493	5,540,333	.99	6,137,358	5,378,304	.88

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Total sand and gravel."

Stone.—*Limestone.*—Eighty-two producers crushed limestone at 110 quarries in 65 counties. Leading counties were Powell, Jefferson, and Livingston. Leading producers were Kentucky Stone Co. (Anderson, Breckinridge, Hardin, Jessamine, Lee, Logan, Rockcastle, and Todd Counties), Reed Crushed Stone Co . Inc. (Livingstone County), and Lambert Bros. Division of Vulcan Materials Co. (Fayette and Jefferson Counties). Production increased 14 percent over the 1961 record. Of the total commercial tonnage, 85 percent was hauled by truck, 7 percent by rail, and 8 percent by water.

Sandstone.—Kentucky Flagstone Co., Kentucky Kolor Stone, Inc., and Thomas C. Mayne quarried 1,600 tons of dimension sandstone in Logan and McCreary Counties.

Vermiculite.—Zonolite Co. exfoliated vermiculite from other States and a foreign country at the Wilder plant near Newport.

METALS

Ferroalloys.—Shipments of ferroalloys, including ferromanganese, silicomanganese, silvery pig iron, ferrosilicon, ferrochromium, and ferrochromic silicon increased 8 percent over those of 1961.

Lead.—Byproduct recovery of lead from fluorspar milling increased 13 percent.

Pig Iron and Steel.—Armco Steel Corp. produced foundry and basic pig iron at Ashland; shipments were 16 percent below those of 1961. Steel was produced by Armco Steel Corp. at Ashland and by Acme Steel Co. at Newport. Iron ore consumed was 9 percent domestic and 91 percent imported. Imports, mainly from Labrador, were 14 percent below the 1961 record.

Zinc.—Byproduct recovery of zinc from fluorspar milling increased 2 percent but was 66 percent below the 1951 record.

TABLE 7.—Crushed limestone sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Barren	247,000	$342,070	166,000	$242,400
Bourbon	(1)	(1)	225,437	269,729
Boyle	177,438	273,291	272,261	420,372
Carter	(1)	(1)	493,495	635,546
Casey	(1)	(1)	104,412	159,708
Crittenden	250,000	316,650	(1)	(1)
Fayette	912,261	1,261,623	1,119,769	1,623,328
Franklin	849,825	1,165,131	635,239	811,895
Greenup			6,500	11,050
Hardin	547,118	789,259	756,288	1,004,511
Jefferson	1,856,749	2,642,799	1,382,821	2,050,675
Kenton	12,093	18,139	4,408	6,613
Menifee	(1)	(1)	89,124	143,777
Mercer	137,000	194,800	205,740	290,783
Morgan	172,035	212,575	254,564	355,401
Muhlenberg	302,954	393,874	(1)	(1)
Nicholas	34,000	67,500	40,300	75,900
Oldham	(1)	(1)	421,612	496,183
Powell	(1)	(1)	1,591,211	2,593,686
Simpson	(1)	(1)	112,318	170,870
Taylor	40,000	40,000	(1)	(1)
Trigg	200,000	250,000	(1)	(1)
Warren	(1)	(1)	497,373	701,581
Undistributed [2]	11,344,494	15,314,469	11,091,747	15,591,151
Total	17,082,967	23,282,180	19,470,619	27,655,159

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes the following counties for which figures are withheld to avoid disclosing individual company confidential data: Adair, Allen, Anderson, Breckinridge, Butler (1962), Caldwell, Christian, Clinton, Cumberland, Edmonson, Estill, Fleming, Garrard (1962), Grayson, Green (1962), Harlan (1962), Harrison, Hart, Henry, Jackson, Jessamine, Laurel (1962), Lee, Letcher (1962), Livingston, Logan, Madison, Marion, Meade, Metcalfe, Monroe, Nelson, Ohio, Pendleton, Pike (1962), Pulaski, Rockcastle, Rowan, Scott (1962), Todd, Washington (1962), Wayne.

TABLE 8.—Crushed limestone sold or used by producers, by uses

Uses	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roads	13,579,183	$18,677,507	$1.38	15,810,275	$22,762,772	$1.44
Agstone [1]	1,535,086	2,098,297	1.37	1,667,020	2,318,972	1.39
Railroad ballast	317,244	335,780	1.06	452,824	473,168	1.04
Stone sand	32,197	45,621	1.42	(2)	(2)	(2)
Other uses [3]	1,619,257	2,124,975	1.31	1,540,500	2,100,247	1.36
Total	17,082,967	23,282,180	1.36	19,470,619	27,655,159	1.42

[1] Agricultural stone.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."

[3] Includes riprap, fluxing stone, fertilizer, poultry grit, cement, other uses, and uses indicated by footnote 1.

REVIEW BY COUNTIES

Of the 120 counties, 107 reported mineral production, compared with 104 in 1961. Leading counties were the large coal and petroleum producers, Muhlenberg, Pike, Hopkins, Harlan, Letcher, Floyd, and Union, which supplied more than 50 percent of the total mineral production value. In addition to detailed county production listed in table 9, natural gas and natural gas liquids, of unde-

termined county origin, were produced. The number of wells and footage drilled by counties, given in this section, was published in the Oil and Gas Journal.[4]

Adair.—Shamrock Stone Co., Inc. (Butler quarry) crushed limestone for concrete, roads, and agricultural stone (agstone).

Allen.—Production of crude petroleum increased 5 percent. Four wells totaling 1,408 feet were drilled. McLellan Stone Co. (Scottsville quarry) crushed limestone for concrete, roads, agstone, and other uses.

Anderson.—Kentucky Stone Co. (Tyrone mine) crushed limestone for concrete, roads, railroad ballast, and agstone.

Ballard.—The Kentucky State Highway Department mined paving sand and gravel.

Barren.—J. F. Pace Construction Co. (Pace quarry) crushed limestone for concrete, roads, agstone, and stone sand. Production of crude petroleum decreased 45 percent. Four wells totaling 996 feet were drilled.

Bath.—Production of crude petroleum decreased 4 percent.

TABLE 9.—Value of mineral production in Kentucky, by counties [1]

County	1961	1962	Minerals produced in 1962 in order of value [2]
Adair	(3)	(3)	Limestone.
Allen	(3)	(3)	Petroleum, limestone.
Anderson	(3)	(3)	Limestone.
Ballard	$20,900	$12,860	Sand and gravel.
Barren	574,761	369,915	Limestone, petroleum.
Bath	16,614	15,792	Petroleum.
Bell	6,951,889	7,315,288	Coal.
Boone	(3)	(3)	Sand and gravel.
Bourbon	(3)	269,729	Limestone.
Boyd	383,927	254,530	Coal, miscellaneous clay, petroleum.
Boyle	273,291	420,372	Limestone.
Breathitt	3,806,616	3,842,619	Coal, petroleum.
Breckinridge	(3)	(3)	Petroleum, limestone, sand and gravel.
Bullitt	(3)	(3)	Miscellaneous clay.
Butler	1,808,223	(3)	Petroleum, coal, limestone.
Caldwell	(3)	(3)	Limestone, fluorspar.
Calloway	91,099	70,311	Sand and gravel.
Carlisle	13,000	4,331	Do.
Carroll	(3)	----	
Carter	1,264,459	1,182,536	Limestone, fire clay, coal.
Casey	(3)	260,750	Limestone, petroleum.
Christian	(3)	(3)	Petroleum, limestone, coal.
Clay	5,221,533	4,077,350	Coal.
Clinton	(3)	(3)	Petroleum, limestone, coal.
Crittenden	(3)	(3)	Limestone, fluorspar, barite, petroleum.
Cumberland	(3)	(3)	Petroleum, limestone.
Daviess	(3)	(3)	Petroleum, coal, sand and gravel, miscellaneous clay.
Edmonson	(3)	(3)	Limestone, petroleum.
Elliott	295,643	244,272	Petroleum, coal.
Estill	(3)	(3)	Petroleum, limestone.
Fayette	1,261,623	1,623,328	Limestone.
Fleming	(3)	(3)	Do.
Floyd	21,971,800	20,574,311	Coal, petroleum.
Franklin	1,165,171	811,895	Limestone.
Fulton	96,900	15,062	Sand and gravel.
Gallatin	(3)	(3)	Do.
Garrard	----	(3)	Limestone, petroleum.
Graves	(3)	(3)	Ball clay.
Grayson	(3)	(3)	Limestone, coal, petroleum.
Green	2,859,840	(3)	Petroleum, limestone.
Greenup	272,487	419,006	Fire clay, limestone.
Hancock	1,203,260	(3)	Petroleum, miscellaneous clay, fire clay, coal.
Hardin	792,585	1,012,361	Limestone, petroleum.
Harlan	19,403,439	(3)	Coal, limestone.

See footnotes at end of table.

[4] Oil and Gas Journal. V. 61, No. 4, Jan. 28, 1963, pp. 202–204.

TABLE 9.—Value of mineral production in Kentucky, by counties [1]—Continued

County	1961	1962	Minerals produced in 1962 in order of value [2]
Harrison	(3)	(3)	Limestone.
Hart	(3)	(3)	Limestone, petroleum.
Henderson	(3)	(3)	Petroleum, coal, sand and gravel.
Henry	(3)	(3)	Limestone, gem stones.
Hickman	$25,800	$8,973	Sand and gravel.
Hopkins	37,585,591	(3)	Coal, petroleum, miscellaneous clay.
Jackson	(3)	(3)	Limestone, coal, petroleum.
Jefferson	(3)	(3)	Cement, limestone, sand and gravel, miscellaneous clay.
Jessamine	(3)	(3)	Limestone.
Johnson	1,174,830	1,147,332	Coal, petroleum.
Kenton	[5] 18,139	6,613	Limestone.
Knott	[5] 5,924,455	6,276,739	Coal, petroleum.
Knox	850,548	939,840	Do.
Laurel	120,539	(3)	Coal, limestone, petroleum.
Lawrence	1,103,390	1,273,323	Petroleum, coal.
Lee	(3)	(3)	Petroleum, limestone, coal.
Leslie	7,015,542	6,943,484	Coal, petroleum.
Letcher	24,011,905	(3)	Coal, limestone, petroleum.
Lincoln	48,141	23,061	Petroleum.
Livingston	(3)	(3)	Limestone, fluorspar, zinc, lead, sand and gravel, silver.
Logan	(3)	(3)	Limestone, sandstone, sand and gravel, petroleum.
Lyon	15,340	376	Sand and gravel.
Madison	(3)	(3)	Limestone.
Magoffin	3,533,967	3,146,507	Petroleum, coal.
Marion	(3)	(3)	Limestone.
Marshall	(3)	12,849	Sand and gravel.
Martin	118,989	371,382	Coal, petroleum.
Mason	113,600	134,400	Sand and gravel.
McCracken	(3)	(3)	Do.
McCreary	1,798,779	1,324,802	Coal, petroleum, sandstone.
McLean	2,282,438	2,676,848	Petroleum, coal.
Meade	(3)	(3)	Limestone, petroleum.
Menifee	(3)	145,302	Do.
Mercer	194,800	290,783	Limestone.
Metcalfe	(3)	(3)	Petroleum, limestone.
Monroe	(3)	(3)	Limestone, petroleum.
Morgan	391,416	516,021	Limestone, coal, petroleum.
Muhlenberg	41,090,334	(3)	Coal, petroleum, limestone.
Nelson	(3)	(3)	Limestone.
Nicholas	67,500	75,900	Do.
Ohio	(3)	(3)	Coal, petroleum, limestone.
Oldham	(3)	496,183	Limestone.
Owsley	204,256	14,448	Coal, petroleum.
Pendleton	(3)	(3)	Limestone.
Perry	14,950,097	14,544,922	Coal, petroleum.
Pike	33,599,073	(3)	Coal, petroleum, limestone, sand and gravel.
Powell	(3)	(3)	Limestone, petroleum, miscellaneous clay.
Pulaski	(3)	(3)	Limestone, coal.
Rockcastle	(3)	(3)	Do.
Rowan	727,849	669,840	Limestone, fire clay, miscellaneous clay.
Russell	31,432	16,010	Petroleum.
Scott	----------	(3)	Limestone.
Simpson	(3)	203,563	Limestone, petroleum.
Taylor	777,273	(3)	Petroleum, limestone.
Todd	(3)	(3)	Limestone, petroleum.
Trigg	250,000	(3)	Limestone.
Trimble	----------	(3)	Sand and gravel.
Union	15,281,953	14,774,999	Coal, petroleum, sand and gravel, miscellaneous clay.
Warren	(3)	833,584	Limestone, petroleum.
Washington	----------	(3)	Limestone.
Wayne	(3)	(3)	Limestone, petroleum, coal.
Webster	6,031,000	5,428,312	Petroleum, coal.
Whitley	(3)	(3)	Coal, petroleum, miscellaneous clay.
Wolfe	132,388	126,079	Petroleum, coal.
Undistributed [4]	[5] 114,567,576	294,298,907	
Total	[5] 383,788,000	399,518,000	

[1] Excludes natural gas and natural gas liquids; included with "Undistributed." The following counties did not report production: Bracken, Campbell, Clark, Grant, Larue, Lewis, Montgomery, Owen, Robertson, Shelby, Spencer, and Woodford.
[2] Other than natural gas and natural gas liquids.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Includes natural gas, natural gas liquids, and values indicated by footnote 3.
[5] Revised figure.

Bell.—One hundred and ten mines produced coal; the leading producers were Mill Creek Coal Co., Inc. (Nos. 1 and 2 mine) and Partin Coal Co. (No. 1 Auger mine).

Boone.—Standard Materials Corp. (Belleview mine), R. W. Greene, Jr., Sand and Gravel Co., Inc. (Burlington mine), and Kentucky Sand Co. (Taylorsport mine) mined sand and gravel for structural, paving, and fill uses.

Bourbon.—Bourbon Limestone Co., Inc. (Snapp quarry), and Hinkle Construction Corp. (Farmers quarry) crushed limestone for concrete, roads, agstone, and stone sand.

Boyd.—Four mines produced coal, the leading producer was Rush Coal Corp. (No. 1 Strip mine). Big Run Coal & Clay Co., Inc. (Princess mine), mined miscellaneous clay for heavy clay products. Production of crude petroleum decreased 19 percent. Armco Steel Corp. produced pig iron and steel at its Ashland plant. Allied Chemical Corp. produced metallurgical coke at its Ashland plant.

Boyle.—Caldwell Stone Co., Inc. (Danville quarry), and Boyle County Highway Department (Perryville quarry) crushed limestone for concrete, roads, and agstone.

Breathitt.—Ten mines produced coal. The leading producers were Island Creek Coal Co. (No. 3 Elkhorn mine) and Kentucky River Collieries (No. 1 Strip mine). Production of crude petroleum decreased 39 percent, and 30 wells totaling 42,951 feet were drilled.

Breckinridge.—Production of crude petroleum decreased 42 percent; 24 wells totaling 9,945 feet were drilled. Kentucky Stone Co. (Webster quarry) and White Stone Co. (Hardinsburg quarry) produced limestone for riprap, concrete, roads, railroad ballast, and agstone. Cloverport Sand & Gravel Co. (Cloverport mine) mined sand and gravel for structural and paving uses.

Bullitt.—Kenlite Division of Kentucky Light Aggregates, Inc., (Shepherdsville mine), mined miscellaneous clay for lightweight aggregates.

Butler.—Production of crude petroleum decreased 4 percent; 93 wells totaling 41,265 feet were drilled. Six mines produced coal, the leading producer being Williams Bros. Stripping Corp. (South Hill Strip mine). Gary Bros. Crushed Stone Co. (Morgantown quarry), crushed limestone for concrete, roads, and agstone.

Caldwell.—Cedar Bluff Stone Co., Inc. (Cedar Bluff mine), and Fredonia Valley Quarries, Inc. (Fredonia quarry), crushed limestone for concrete, roads, and agstone. James Green (Tyree mine) mined a small quantity of fluorspar. Three oil wells totaling 3,538 feet were drilled.

Calloway.—Murray Silica Sand Co. (Murray mine) mined silica sand for use as a glass sand. The Calloway County Highway Department and the State highway department mined sand and gravel for paving.

Campbell.—Zonolite Co. exfoliated crude vermiculite shipped into the State at the Wilder plant.

Carlisle.—The State highway department mined paving sand and gravel.

Carter.—Acme Stone Co., Inc. (Olive Hill quarry), Standard Slag Co. (Carter quarry), and Carter County Stone Co. crushed limestone

for concrete, roads, and agstone. Thirteen mines produced fire clay for firebrick and block and fire-clay mortar; the leading producers were General Refractories Co. (Christian and Little Hill mines) and Elton Hensley (Bailey mine). Moore Branch Coal Co. (No. 3 mine), Kentucky Eagle Coal & Clay Co. (No. 1 mine), and Sparks & Durham Coal Co. (No. 1 mine) were the active producers. Six oil wells totaling 5,773 feet were drilled.

Casey.—Casey Stone Co. (Bethel Ridge mine) crushed limestone for concrete, roads, and agstone. Production of crude petroleum increased 43 percent, one well totaling 1,680 feet was drilled.

Christian.—Production of crude petroleum decreased 28 percent, and 18 wells totaling 18,335 feet were drilled. Hopkinsville Stone Co., Inc. (Hopkinsville quarry), Christian Quarries, Inc., and Harry Berry, Inc. (Fort Campbell quarry), crushed limestone for concrete, roads, and agstone. Ralph Ligon, Inc. (No. 6 Strip mine), was the only coal producer.

Clay.—Sixty-one coal mines were active, the leading producers being Sheperd Coal Co. (Lick Branch mine), Shamrock Coal Co. (No. 9 mine), and Mary Gail Coal Co. (No. 5 mine). Seven oil wells totaling 11,876 feet were drilled.

Clinton.—Production of crude petroleum decreased 31 percent, and four wells totaling 2,636 feet were drilled. Shamrock Stone, Inc. (Caldwell quarry), crushed limestone for concrete, roads, and agstone. M. & G. Coal Co. (No. 1 mine) and O. D. Gwinn (Gwinn mine) were the active coal producers.

Crittenden.—Alexander Stone Co., Inc. (No. 1 quarry), produced limestone for riprap, concrete, roads, and agstone. J. Willis Crider Fluorspar Co. (Pigmy mine) and Craighead & Coates (Stallions mine) mined metallurgical-grade fluorspar. Kentucky Fluorspar Co. and Roberts & Frazier purchased fluorspar from local producers for shipment to consumers. Calvert City Chemical Co. treated fluorspar ore from its Dyer's Hill mine in Livingstone County, in its flotation mill at Mexico, recovering fluorspar for use in manufacturing hydrofluoric acid. J. Willis Crider Fluorspar Co. (Pigmy mine) mined barite for use in oil well drilling. A small quantity of crude petroleum was reported.

Cumberland.—Production of crude petroleum increased by 1 percent. Shamrock Stone, Inc. (Wells quarry), crushed limestone for concrete, roadstone, and agstone.

Daviess.—Production of crude petroleum increased by 6 percent, and 246 wells totaling 242,298 feet were drilled. Four mines produced coal, the leading producer was Green Coal Co. (K–9 Strip mine). Owensboro River Sand & Gravel Co. and Daviess County Sand & Gravel Co. mined sand and gravel for structural, paying, fill, and other uses. Joseph L. Clark Tile Co. (Moselyville mine) mined miscellaneous clay for heavy clay products.

Edmonson.—Nolin Stone Co., Inc. (Bee Spring quarry), and McLellan Stone Co. (Park City quarry) crushed limestone for concrete, roads, and agstone. Production of crude petroleum decreased 46 percent.

Elliott.—Production of crude petroleum decreased 19 percent, and 22 wells totaling 20,864 feet were drilled. Copley Coal Co. (No. 2 mine) was the leading producer among the four active coal mines.

Estill.—Production of crude petroleum increased 51 percent, and five wells totaling 2,808 feet were drilled. Estill County Stone Co., Inc. (Estill mine), produced limestone for riprap, concrete, roads, and agstone.

Fayette.—Lambert Bros. Division of Vulcan Materials Co., Central Rock Co., Inc. (Lexington quarry and Lexington mine), and Blue Grass Stone Co., Inc., produced limestone for concrete, roads, and agstone.

Fleming.—Gorman Construction Co., Inc. (Carpenter quarry), crushed limestone for concrete, roads, and agstone.

Floyd.—The county ranked sixth in the State in total value of mineral production. Two hundred and forty-six mines produced coal, and the leading producers were Inland Steel Co. (Wheelwright mine) and Princess Coals, Inc. (No. 1 and Permele No. 2 mines). Production of crude petroleum decreased 44 percent, and 54 wells totaling 99,008 feet were drilled.

Franklin.—Blanton Stone Co., Inc. (Frankfort mine), Franklin County Stone Co. (Franklin mine), and Frankfort Builders Supply Co., Inc. (Devil's Hollow mine), crushed limestone for concrete, roads, and agstone.

Fulton.—The State highway department mined paving gravel.

Gallatin.—Standard Materials Corp. (Warsaw mine) and C & H Gravel Co., Inc. (Sam Hill mine), mined sand and gravel for structural and paving uses.

Garrard.—Camp Nelson Stone Co., Inc. (Lancaster quarry), crushed limestone for concrete and roads. A small quantity of crude petroleum was reported.

Graves.—Kentucky–Tennessee Clay Co. (Kentucky mine) and Old Hickory Clay Co. (Hickory and Lampkin mines) mined ball clay for whiteware, art pottery, enameling, floor and wall tile, firebrick and block, foundries and steelworks, plastics, and exports.

Grayson.—Rogers & Brunnhoeffer (Grayson quarry) and Ragland Bros. (Leitchfield quarry) crushed limestone for concrete, roads, and agstone. Riverline Mining Co. Inc. (Riverline strip mine) was the only coal producer. A small quantity of crude petroleum was reported. One well totaling 449 feet was drilled.

Green.—Production of crude petroleum decreased 48 percent. One well totaling 639 feet was drilled. Nally & Gibson Stone Co. (Greensburg quarry) crushed limestone for concrete and roads.

Greenup.—Six mines produced fire clay for firebrick and block, fireclay mortar, heavy clay products, and other clay specialties. The leading producers were Davis Fire Brick Co. and Harbison-Walker Refractories Co. (Riggs mine). Greenup County Highway Department crushed limestone for concrete and roads.

Hancock.—Production of crude petroleum decreased 20 percent, and 30 wells totaling 17,652 feet were drilled. Four mines produced miscellaneous clay for heavy clay products, the leading producer being Cannelton Sewer Pipe Co. (No. 1 mine). Murray Tile Co. mined fire clay for floor and wall tile use. Green Coal Co. (Hancock County mine) was the only coal producer.

Hardin.—Kentucky Stone Co. (Lilmay mine and Upton quarry), Osborne Bros., and Waters Construction Co. produced limestone for

riprap, concrete, roads, agstone, and fertilizer filler. Production of crude petroleum was more than double that reported in 1961.

Harlan.—The county ranked fourth in the State in value of mineral production. One hundred and sixty-six mines produced coal; the leading producers were United States Steel Co. (No. 32 mine), Stonega Coke & Coal Co. (Glenbrook High Splint mine), and International Harvester Co. (No. 4 mine). Nally & Boone Stone Co. (Harlan quarry) crushed limestone for concrete, roads, and agstone.

Harrison.—Genet Stone Co. (Cynthiana quarry) and Harrison County Highway Department crushed limestone for concrete, roads, and agstone.

Hart.—McLellan Stone Co. (Horse Cave quarry) crushed limestone for concrete, roads, and agstone. Production of crude petroleum decreased 36 percent. Two wells totaling 1,560 feet were drilled.

Henderson.—Production of crude petroleum increased 15 percent, and 81 wells totaling 176,680 feet were drilled. Goldsberry Coal Co. (No. 2 mine), Community Coal Co. (Community mine), and Dolph Hazlewood Coal Co. (Mike & Pat mine) were the leading producers among the seven active coal mines. Evansville Materials, Inc., mined sand and gravel for structural, paving, and fill uses.

Henry.—Geoghegan & Mathis, Inc. (Lockport quarry) crushed limestone for concrete and roads. The Major Rocks collected a small quantity of gem stones (mineral specimens).

Hickman.—The State highway department mined paving gravel.

Hopkins.—Hopkins County ranked third in the State in value of mineral production. Thirty-one mines produced coal. The leading producers were West Kentucky Coal Co. (Pleasant View mine), Nashville Coal Co., Inc. (Fies mine), and Peabody Coal Co. (White City strip mine). Production of crude petroleum was more than tripled that reported in 1961, and 39 wells totaling 98,062 feet were drilled. Green River Clay Products (Ashbyburg mine) mined miscellaneous clay for heavy clay products.

Jackson.—M. A. Walker Co., Inc. (Indian Creek and Clover Bottom mines), crushed limestone for concrete, roads, and agstone. Hamm Coal Co., Inc. (No. 1 strip mine), and T. R. Marcum Coal Co. (No. 1 mine) were the only active coal producers. Production of crude petroleum decreased 4 percent, and one well totaling 1,125 feet was drilled.

Jefferson.—Kosmos Portland Cement Co., Inc., produced masonry and portland cements at the Kosmosdale mill. Limestone was crushed at five quarries and one mine for concrete, roads, railroad ballast, and agstone. The major producers were Louisville Crushed Stone Co., Inc. (Louisville mine), and Lambert Bros. (Okolona quarry). Six mines produced sand and gravel for structural, paving, fill, and fertilizer filler uses. The leading producers were Nugent Sand Co. and E. T. Slider, Inc. Kosmos Portland Cement Co. (Kosmosdale mine) and General Shale Products Co. (Coral Ridge mine) mined miscellaneous clay for cement manufacture and heavy clay products. Air Reduction Chemical & Carbide Co. regenerated lime for chemical and industrial uses at its Louisville plant.

Jessamine.—Kentucky Stone Co. (High Bridge mine) crushed limestone for concrete, roads, railroad ballast, and agstone.

Johnson.—Forty-three mines produced coal, and the leading producers were Stambaugh Coal Co. (No. 1 mine), Bob Cantrell Coal Co. (No. 7 mine), and Springfield Coal Co. (No. 1 mine). Production of crude petroleum increased 21 percent and 190 wells totaling 139,540 feet were drilled.

Kenton.—Franxman Bros. (Covington quarry) crushed limestone for concrete and roads.

Knott.—Pine Bluff Coal Co. (No. 1 Auger mine), R. R. Crawford (Nos. 2 and 3 mines), and Mountain Top Stripping Co. Inc. (No. 1 Strip mine) were the leading producers among the 153 active coal mines. Production of crude petroleum decreased 16 percent, and 19 wells totaling 112,345 feet were drilled.

Knox.—Kentucky-Knox Mining Co. (No. 1 Strip and No. 2 Auger mines) and Evans Coal Co. (No. 3 mine) were the principal producers among the 53 active coal mines. Production of crude petroleum decreased 46 percent. Two wells totaling 725 feet were drilled.

Laurel.—B. R. Campbell & Sons, Inc. (No. 1 and Lily mines), and Hap Coal Co. (No. 1 mine) were the leading producers of the eight active coal mines. Laurel County Stone Co. crushed limestone for concrete, roads, and agstone. Production of crude petroleum decreased 24 percent, and one well totaling 1,662 feet was drilled.

Lawrence.—Production of crude petroleum increased 11 percent, and 348 wells totaling 332,262 feet were drilled. Moore Branch Coal Co. (No. 2 Strip mine), C & C Coal Co. (Van Horn No. 1 mine), and Kazee Coal Co. (No. 1 mine) were the active coal producers.

Lee.—Production of crude petroleum increased 12 percent, and 119 wells totaling 70,727 feet were drilled. Kentucky Stone Co. (Yellow Rock mine) crushed limestone for concrete, roads, railroad ballast, and agstone. Congleton Bros. Coal Co. (Nos. 3 and 4 Pacemaker mines) and Cave Branch Coal Co. (No. 1A mine) were the active coal producers.

Leslie.—Thirty-two mines produced coal, and the leading producers were Deby Coal Co. (Deby No. 3 mine), Mary Gail Coal Co. (No. 7 mine), and Kentucky Mountain Coal Co. (No. 6 mine). Production of crude petroleum decreased 16 percent.

Letcher.—The county ranked fifth in the State in value of mineral production. One hundred and eighty-three mines produced coal, and the foremost producers were Bethlehem Mines Corp. (Nos. 21 and 22 mines) and Elkhorn Jellico Coal Co. (Sapphire No. 2 mine). Hurrican Gap Quarries, Inc., crushed limestone for concrete and roads. Production of crude petroleum decreased 20 percent. Six wells totaling 19,584 feet were drilled.

Lincoln.—Production of crude petroleum decreased 52 percent; one well totaling 217 feet was drilled.

Livingston.—Reed Crushed Stone Co., Inc. (Grand Rivers quarry), and Three River Rock Co. produced limestone for riprap, concrete, roads, and agstone. Byproduct zinc, lead, and silver were recovered from fluorspar milling. Calvert City Chemical Co. mined fluorspar ore at the Dyer's Hill mine and treated it in the Mexico mill in Crittenden County to recover acid-grade fluorspar. The Kentucky

Fluorspar Co. purchased the old Klondike mine and produced a small quantity of fluorspar. Taylor Sand & Gravel Co. (Barkley Dam mine) and the State highway department mined sand and gravel for structural and paving uses.

Logan.—Kentucky Stone Co. (Russellville mine) produced limestone for riprap, concrete, roads, railroad ballast, and agstone. Kentucky Flagstone Co., Inc. (Lewisburg quarry), and Kentucky Kolor Stone, Inc. (Russellville quarry) quarried dimension sandstone for rough building stone and flagging. Kemp Construction Co. (Lewisburg mine) mined paving sand. Production of crude petroleum decreased 33 percent, and 22 wells totaling 17,708 feet were drilled.

Lyon.—The State highway department mined paving gravel.

Madison.—Boonesboro Quarry, Inc. (Boonesboro mine), crushed limestone for concrete, roads, agstone and other uses.

Magoffin.—Production of crude petroleum decreased 7 percent, and and 32 wells totaling 43,103 feet were drilled. Tip Top Coal Co. (Nos. 8 New, 12, and 22 mines), Marsillett Coal Co. (No. 12 mine), and Bach & Brown Coal Co. (No. 1 mine) were the active coal producers.

Marion.—Ward & Montgomery (Lebanon quarry) and Lebanon Stone Co., Inc., crushed limestone for concrete, roads, and agstone.

Marshall.—The State highway department mined paving gravel. Air Reduction Chemical & Carbide Co. regenerated lime for chemical and industrial use at Calvert City. Pittsburgh Metallurgical Co. produced ferroalloys at its Calvert City plant. New York Mining & Manufacturing Co. produced metallurgical coke at its Calvert City plant.

Martin.—Wolf Creek Coal Co. (No. 1 mine) and Spence & Fannin Coal Co. (No. 2 mine) were the active coal producers. Production of crude petroleum decreased 4 percent, and nine wells totaling 28,267 feet were drilled.

Mason.—J. F. Hardyman Co. mined sand and gravel for structural, paving, and fill uses. One oil well totaling 1,065 feet was drilled.

McCracken.—Federal Materials Co., Inc. (Paducah mine), mined sand and gravel for structural and paving uses.

McCreary.—Stearns Coal & Lumber Co. (No. 16–2, No. 4 East Section, and No. 18 Slaven mines), O & S Coal Co. (Nos. 1, 2, and 4 mines), and B. R. Campbell & Son, Inc. (Pleasant Run strip mine), were the active coal producers. Crude petroleum production increased 16,000 barrels, and four wells totaling 2,900 feet were drilled. Thomas C. Mayne quarried dimension sandstone for rough building stone at the Day Ridge quarry.

McLean.—Production of crude petroleum increased 20 percent, and 141 wells totaling 132,853 feet were drilled. Highview Coal & Construction Co. (Centertown No. 1 strip mine) was the only active coal producer.

Meade.—Kosmos Portland Cement Co. (Limestone quarry), Owensboro River Sand & Gravel Co. Inc. (Riverside mine), and Doe Run Stone Co. crushed limestone for concrete, roads, agstone, and cement use. Production of crude petroleum was reported, and one well totaling 460 feet was drilled.

Menifee.—A. W. Walker & Son (Frenchburg mine) crushed limestone for concrete, roads, and agstone. Initial production of crude petroleum was reported. Two wells totaling 2,822 feet were drilled.

Mercer.—Mercer Stone Co. and Mercer County Highway Department crushed limestone for concrete, roads, and agstone.

Metcalfe.—Production of crude petroleum decreased 15 percent, and six wells totaling 1,987 feet were drilled. Montgomery & Co. (Chapman quarry) crushed limestone for concrete, roads, and agstone.

Monroe.—Trico Stone, Inc. (Monroe quarry), crushed limestone for concrete, roads, and agstone. Production of crude petroleum decreased 90 percent.

Morgan.—Kentucky Road Oiling Co. (Wrigley quarry), Licking River Limestone Co. (Zag quarry), and Morgan County Limestone, Inc. (Sandy Hook quarry), produced limestone for riprap, concrete, roads, and agstone. Marshall & Sheets Coal Co. (No. 2 Strip mine) was the only coal producer. Production of crude petroleum decreased 40 percent and three wells totaling 2,463 feet were drilled.

Muhlenberg.—The county led the State in value of mineral production. Twenty-one mines produced coal; the leading producers were River Queen Coal Co. (River Queen strip mine), Peabody Coal Co. (Vogue strip mine), and Gibraltar Coal Corp. (Gibraltar strip mine). Greenville Quarries, Inc. (Greenville quarry) crushed limestone for concrete, roads, and agstone. Production of crude petroleum decreased 11 percent; 78 wells totaling 76,002 feet were drilled.

Nelson.—Geoghegan & Mathis, Inc. (Nelson quarry), crushed limestone for concrete and roads.

Nicholas.—Nicholas County Highway Department (County quarry) crushed limestone for concrete and roads.

Ohio.—Twelve mines produced coal. The leading producers were Peabody Coal Co. (Ken strip and Ken Highwall No. 2 mines) and Riverview Coal Co. Inc. (No. 1 strip mine). Production of crude petroleum decreased 4 percent, and 108 wells totaling 66,560 feet were drilled. Fort Hanford Stone Co., Inc. (Hartford mine), and State Contracting & Stone (Hartford quarry) produced limestone for riprap, concrete, roads, railroad ballast, and agstone.

Oldham.—Ohio River Stone Co. (Prospect quarry), Joe Clark Stone Co. (Clark quarry), and Liter's Quarry, Inc. (Crestwood mine), crushed limestone for concrete, roads, and agstone.

Owsley.—Adam McIntosh Coal Co. (No. 1 mine) was the only active coal producer. Production of crude petroleum decreased 17 percent. Six wells totaling 9,361 feet were drilled.

Pendleton.—Geoghegan & Mathis, Inc. (Butler and Falmouth quarries), crushed limestone for concrete and roads.

Perry.—Eighty-seven mines produced coal. The leading producers were Blue Diamond Coal Co. (Leatherwood Nos. 1 and 2 mines) and Blair Fork Coal Co. (Blair Fork mine). Production of crude petroleum decreased 1 percent, and 40 wells totaling 120,962 feet were drilled.

Pike.—The county ranked second in the State in value of mineral production. Coal was produced at 585 mines; the leading producers were Eastern Coal Corp. (Stone mine), Kentland-Elkhorn Coal Corp. (Kentland No. 1 mine), and Republic Steel Corp. (Republic

mine). Production of crude petroleum decreased 20 percent; 60 wells totaling 207,592 feet were drilled. Johnson Bros. Limestone Co. crushed limestone for concrete and roadstone. Pike Sand Co. (Walters mine) mined structural sand.

Powell.—Natural Bridge Stone, Inc. (Stanton quarry), Ruth-Lambert Stone Co. (Stanton quarry), and A. W. Walker & Son (Whiterock quarry) crushed limestone for concrete, roads, and agstone. Production of crude petroleum increased 9 percent, and 14 wells totaling 12,752 feet were drilled. H. B. Sipple Brick Co. (Drake No. 1 mine) and Big Run Coal & Clay Co. (West Bend mine) mined miscellaneous clay for heavy clay products.

Pulaski.—Strunk Construction Co., Inc. (Tateville quarry), and Somerset Stone Co., Inc. (Somerset quarry), produced limestone for riprap, concrete, roads, railroad ballast, and agstone. Ikerd-Bandy Co., Inc. (Nos. 3 and 4 Strip mines), was the leading producer of the six active coal mines. Three oil wells totaling 5,066 feet were drilled.

Rockcastle.—Kentucky Stone Co. (Mullins and Mt. Vernon mines) crushed limestone for concrete, roads, railroad ballast, and agstone. Likins Coal Co. (No. 1 Strip mine) and Black Diamond Coal Co. (No. 1 mine) were the active coal producers. One oil well totaling 373 feet was drilled.

Rowan.—Morehead Limestone, Inc., and Kentucky Road Oiling Co. (Christy quarry) produced limestone for fluxing stone, concrete, roads, and agstone. Eight mines produced fire clay for firebrick and block, the leading producer being Cogswell-Fultz Strip mine (General Refractories Co.). Lee Clay Products Co., Inc. (Lee Clay mine), mined miscellaneous clay for heavy clay products. One oil well totaling 242 feet was drilled.

Russell.—Production of crude petroleum decreased 49 percent, and one well totaling 575 feet was drilled.

Scott.—Nally & Gibson Stone Co. (Georgetown quarry) crushed limestone for concrete and roads.

Simpson.—Southern Stone Co., Inc. (Franklin quarry), crushed limestone for concrete, roads, and agstone. Production of crude petroleum increased 14 percent.

Taylor.—Production of crude petroleum decreased 96 percent. Nally & Gibson Stone Co. crushed limestone for concrete and roads.

Todd.—Kentucky Stone Co. (Todd quarry) and D. W. Dickinson & Son (Gallatin quarry) produced limestone for riprap, concrete, roads, and agstone. Production of crude petroleum decreased 27 percent, and two wells totaling 2,854 feet were drilled.

Trigg.—Cedar Bluff Stone Co. (Canton quarry) crushed limestone for concrete, roads, and agstone.

Trimble.—Standard Materials Corp. (Milton mine) mined sand and gravel for structural and paving uses.

Union.—The county ranked seventh in the State in value of mineral production. Nashville Coal, Inc. (Uniontown mine), P & M Coal Mining Co. (Dekoven mine), and Klondike, Inc. (Calloway mine), were the three active coal producers. Production of crude petroleum decreased 6 percent; 19 wells totaling 44,922 feet were drilled. Union Sand & Gravel Co. (Morganfield mine) mined sand and gravel

for structural and paving use. Clarks Clay Products Co. (Uniontown mine) mined miscellaneous clay for heavy clay products.

Warren.—Gary Bros. Crushed Stone Co., McLellan Stone Co. (Smith Grove and Warren County quarries), and White Stone Quarry (Bowling Green quarry) crushed limestone for concrete, roads, agstone, and other uses. Production of crude petroleum increased by 10 percent.

Washington.—Nally & Gibson Stone Co. (Washington quarry) crushed limestone for concrete and roads.

Wayne.—Bassett Products Co. (Bassett quarry) crushed limestone for concrete, roads, and agstone. Production of crude petroleum decreased 41 percent. Nine wells totaling 5,074 feet were drilled. Harvey Worley Coal Co. (No. 2 mine) was the only coal producer.

Webster.—Production of crude petroleum increased 36 percent. There were 23 wells drilled totaling 46,067 feet. Sextet Mining Corp. (Choctaw Strip mine), Hart & Hart Coal Co. (Precision Washed Strip mine), and Quisenberry Bros. Mining Co. (Quisenberry Strip mine) were the leading coal producers of the six active mines.

Whitley.—Thirty-seven mines produced coal. The leading producers were Round Mountain Coal Co., Inc. (No. 1 Strip and No. 1 Auger mines) and Callihan Coal Co., Inc. (Brummet Auger mine). Production of crude petroleum decreased 25 percent, and 26 wells totaling 26,199 feet were drilled. Corbin Brick Co. Inc. (Corbin mine), mined miscellaneous clay for heavy clay products.

Wolfe.—Production of crude petroleum decreased by 16 percent, and 10 wells totaling 16,960 feet were drilled. C. L. Thompson Coal Co. (Miller mine) and Herman Nickell Coal Co. (No. 1 mine) were the active coal producers.

The Mineral Industry of Louisiana

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Louisiana Geological Survey for collecting information on all minerals except fuels.

By Peter Grandone [1] and Leo W. Hough [2]

LOUISIANA ranked second among the States in value of mineral production for the fifth consecutive year. To keep pace with accelerated industrial development in the State, new records were achieved in production of crude petroleum, natural gas, natural gas liquids, and salt (in order of value).

Louisiana's mineral industry was dominated by crude petroleum, natural gas, and natural gas liquids, which furnished 95 percent of the total value of mineral output. Proved recoverable reserves of these fuels reached new highs despite increased production. In quantity of reserves added during 1962, Louisiana ranked first in the Nation for all three fuels. Nationally, recoverable reserves showed gains for natural gas and natural gas liquids and a loss for petroleum.

TABLE 1.—Mineral production in Louisiana [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays—thousand short tons	645	$645	638	$641
Lime—do	[2] 636	[2] 6,292	624	6,519
Natural gas—million cubic feet	3,271,857	611,837	3,525,456	694,515
Natural gas liquids:				
Natural gasoline and cycle products—thousand gallons	931,176	61,714	1,010,137	74,726
LP gases—do	806,559	33,214	862,772	29,037
Petroleum (crude)—thousand 42-gallon barrels	424,962	1,338,160	[3] 483,101	[3] 1,521,274
Salt—thousand short tons	4,722	23,357	5,248	27,407
Sand and gravel—do	12,042	14,833	12,040	14,817
Stone (shell)—do	4,641	7,656	5,711	8,067
Sulfur (Frasch process)—thousand long tons	2,352	55,164	2,262	49,772
Value of items that cannot be disclosed: Cement, gypsum, and miscellaneous stone	----------	15,807	----------	18,554
Total	----------	[2] 2,168,679	----------	2,445,329

[1] Production as measured by mine shipments, sales, or marketable production including consumption by producers.
[2] Revised figure.
[3] Preliminary figure.

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[2] State geologist, Louisiana Geological Survey, Baton Rouge, La.

Trends and Developments.—Construction of new plants and additions to existing petrochemical plants, natural gasoline plants, and refineries continued at a high level throughout the year. The Louisiana State Board of Commerce and Industry approved ad valorem tax exemptions on a total investment of $131 million in applications for new manufacturing plants and expansions of existing plants. About 81 percent of the total investment approved was for plants of the power, fuels, and mineral industries. Applications approved in 1961 for new industrial facilities totaled $185 million. Largest of the applications approved were $24.8 million for the Du Pont plant at Laplace, $19.6 million for the Gulf States Utilities powerplant at Sunshine, $9.4 million for the Cities Service Refining Corp. butyl rubber plant at Lake Charles, $8 million for the Humble Oil & Refining Co. coking unit at Baton Rouge, and $3 million for the U.S. Rubber Co. plant at Geismar.

Impressive plant additions were made at four locations. The multimillion dollar petrochemical complex started by Monochem, Inc., at Geismer on the Mississippi River was enlarged to eight facilities. Proposed and actual constructions at the Geismar site during the year were made by Allied Chemical Corp. and Union Texas Petroleum Division, Naugatuck Chemical Division of U.S. Rubber Co., Borden Co., and Morton Chemical Co.

At Baton Rouge, Humble Oil & Refining Co. completed a $4 million plant to produce oxo-alcohols and, together with Reynolds Metals Co., announced construction of $10.5 million of facilities to produce and calcine petroleum coke.

At Lake Charles, four new plants were proposed or added to the chemical and refinery complex. These constructions were by Ancon Chemical Co., Hercules Powder Co., Cities Service Refining Co., and Pittsburgh Plate Glass Co. (formerly Columbia-Southern Chemical Co.).

Near New Orleans, the huge Michoud ordnance plant was reactivated further by the National Aeronautic and Space Agency to fabricate booster engines for the Saturn space vehicle. This plant eventually may employ up to 12,000 people and may create a new industrial complex of subcontractor plants to produce numerous component parts. Anticipated facilities and employment in the proposed testing area will enhance the entire economies of St. Tammany Parish, La., and Pearl River County, Miss. Also for the New Orleans area, E. I. du Pont de Nemours & Co., Inc., planned a $20 million plant at Laplace, and Oklahoma Cement Co. planned a $12 million plant on the Michoud ship canal.

Discovery of 40 oil and gas fields (26 onshore and 14 offshore) ranked Louisiana first in the Nation in added reserves of oil and gas. To provide for rapid development and marketing of new gas supplies, the industry added new facilities consisting of five gas-processing plants, storage space in salt dome caverns for recovered plant liquids, two major products pipelines for transporting these fuels through and from the State to eastern seaboard markets, and a major transmission line connecting with offshore gas reserves.

The salt industry made significant additions in mining and chemical plants. In St. Mary Parish, a new salt mine was developed at

Belle Isle salt dome and another was under development at Cote Blanche salt dome to bring five coastal domes into production. New plant facilities to produce chlorine and other chemicals from salt were completed at Weeks Island and Geismar.

The Mississippi River is one of the greatest industrial attractions to the Baton Rouge-New Orleans area. The river is the Nation's largest fresh-water supply, with an average flow of over 300 billion gallons per day—more water than is used in the entire Nation. The river is navigable for large oceangoing vessels as far as Baton Rouge and provides barge transportation to stations on the Mississippi, Ohio, Illinois, and Missouri Rivers. The Mississippi River-Gulf Outlet, which shortens the shipping distance between New Orleans and the Gulf by 50 miles, provided one-way ship traffic. The first 8 miles were completed to project dimensions (36 feet deep, 500 feet wide); when finished in 1969, the channel will provide full two-way traffic.

Elsewhere in the State, construction of another major canal and docking facilities was in progress at Lake Charles. The Calcasieu River and Pass, the State's second waterway capable of accommodating seagoing traffic, was being dredged for a deeper and wider channel to permit passage of larger tankers to the port of Lake Charles. The Calcasieu Industrial Board, created by the Port of Lake Charles and Calcasieu Parish Police Jury, contracted with a consulting firm to make a comprehensive economic and industrial study of the parish.

Planning and surveying was in progress on the $60 million Toledo Bend Dam on the Sabine River.

The $3 million Houma navigation channel was opened to traffic in June. The project was financed by parish bonds. The Department of Public Works submitted the original engineering feasibility study.

To keep pace with industrial expansion, New Orleans Public Service, Inc., completed its new 230,000-kilowatt Michoud station at New Orleans. Power from this steam-electric station will help meet the demand of the reactivated Michoud ordnance plant. Gulf States Utilities Co. started a $19.6 million expansion of its Sunshine plant, Iberville Parish. The added unit, a 220,000-kilowatt turbine generator, will supply electric power to the Baton Rouge area. Steam generation in the two plants was by gas fuel.

The Federal Power Commission reported that the total 13,573 million kilowatt-hours generated in 1962 by all Louisiana plants was a 7.8-percent gain for the year, compared with a national gain of 7.6 percent. Also, Louisiana's electric output was about 1.6 percent of the national output, unchanged from 1961.

Legislation.—The dispute concerning ownership of mineral rights in gulf coast tidelands remained unsettled pending completion of the coastal boundary study. A joint team of State Mineral Board and the Federal Coast and Geodetic Survey continued trying to establish a base line for measuring Louisiana's coastal boundary. Louisiana's exceedingly irregular shoreline makes the base line crucial. The U.S. Supreme Court allotted the State a 3-mile limit; congressional action would be required to provide a further limit. Revenues totaling $458 million from offshore leasing in the disputed zones have accumulated in an escrow fund.

Employment and Injuries.—Employment in Louisiana's petroleum industry was 84,400 workers—1,250 fewer than in 1961. In mineral production, including fuels (establishments with four or more employees), employment declined 3 percent. Oil and gas operations provided 92 percent of employment and 93 percent of wages derived from mineral industries. Reported employment in Louisiana's total industry group for 1962 averaged 543,595 workers—up almost 2 percent.

About 900 members of the Oil and Chemical Workers Union of Louisiana went on strike August 18 at the Norco plants of Shell Oil Co. and Shell Chemical Co. The dispute over contract maintenance, severance pay guarantees, work practices, and termination notices remained unsettled at yearend.

TABLE 2.—Employment and wages in the mineral industries [1]

Industry	Average number of workers		Total wages and salaries (thousands)	
	1961	1962 [2]	1961	1962 [2]
Crude petroleum production, natural gas and natural gas liquids	19,630	19,500	$137,106	$142,537
Oil and gas field contract services [3]	20,641	19,460	114,630	121,076
Sand and gravel quarries, pits, and dredges	1,315	1,284	4,839	4,955
Salt mines	780	844	3,912	5,715
Nonmetallic minerals [4]	1,523	1,356	10,816	9,830
Total	43,889	42,444	271,303	284,113

[1] The Louisiana Employment Security Law covers 4 or more employees.
[2] Preliminary figures.
[3] Includes approximately 3,300 workers formerly in service industries. The additional item is geophysical services.
[4] Mainly sulfur, excludes shell production workers.

Source: Louisiana State Department of Labor, Division of Employment Security.

TABLE 3.—Total wage and salaried workers in petroleum production, refining, and related industries

Year	Crude petroleum and natural gas production	Petroleum refining [1]	Pipeline transportation (except natural gas)	Gas utilities	Petroleum bulk tank stations	Retail filling stations	Chemicals manufactured as byproducts of petroleum or used in the refining of petroleum [2]	Total
1953–57 (average)	35,750	15,750	1,460	5,270	4,030	7,410	11,340	81,010
1958	[3] 41,350	15,450	1,400	6,000	4,600	8,600	13,050	90,450
1959	42,100	13,500	1,320	6,380	4,440	9,000	12,100	88,840
1960	[3] 40,150	13,350	1,250	6,400	4,300	8,850	11,650	85,950
1961 [4]	40,300	12,800	1,150	6,350	4,000	8,700	12,350	85,650
1962 [5]	40,250	12,000	1,000	6,250	3,800	8,950	12,150	84,400

[1] Employment in petroleum refineries and petrochemicals manufactured in petroleum refineries.
[2] Employment in petrochemical manufacturing facilities located outside petroleum refineries.
[3] Includes 3,300 formerly in service industries.
[4] Revised figures.
[5] Preliminary figures.

Source: Louisiana State Department of Labor, Division of Employment Security.

TABLE 4.—Value of construction contracts awarded
(Thousand dollars)

Type	1959	1960	1961	1962	Percent change from 1961
Residential [1]	$258,974	$206,129	$219,412	$271,162	+23.6
Nonresidential [2]	171,565	182,227	175,226	192,929	+10.1
Public works and utilities	230,716	190,522	194,043	194,836	+0.4
Total	661,255	578,878	588,681	658,927	+11.9

[1] Includes apartments, hotels, dormitories, and 1- and 2-family dwellings.
[2] Includes commercial manufacturing, educational, and other nonresidential buildings.

Source: Louisiana Business Review. Dodge Statistical Research Service. V. 27, No. 2, February 1963, p. 13.

One employee was killed when he fell beneath a load of bauxite being funneled into a storage building.

Two lives were lost in separate oilfield accidents in Lafourche Parish. A derrick man was killed instantly when he dropped 94 feet to the derrick floor; an engineer-geologist drowned in 50 feet of water when he fell from the offshore drilling rig in Bay Marchand.

An oil rig worker was injured while working on a drilling rig at Nairn.

Three workers were killed in the explosion of a barge they were cleaning at a shipyard 20 miles south of Lake Charles. Ignition of fumes from naphtha used in the cleaning apparently caused the explosion.

The Norwegian tanker *Boheme*, loaded with petrochemicals, exploded and burned October 20 on the Mississippi River near Lutcher, La. The incident occurred when the tanker was rammed fore and aft by some oil barges which had broken free from a tug owned by Victory Towing Co., Greenville, Miss. U.S. Coast Guard rescue teams and inhabitants on the river bank aided in the rescue work. As a result, 10 crewmen were dead, 8 were missing, 8 were hospitalized, and 18 others, including 4 stewardesses, were treated for injuries and released.

One man was killed and four injured from an explosion in the hydrazine unit at a plant at Lake Charles. The explosion shattered windows in nearby West Lake and scattered debris over a wide area.

A plant guard died when he and three other workers were overcome by fumes in a barge.

A pipeline crewman was killed from dirt cave-in while working in a 10-foot-deep ditch near Iowa, La.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Louisiana continued to be a leading domestic producer of crude petroleum and natural gas and a major supplier of natural gas liquids and refined petroleum products. The State also had a relatively high rate of activity in all branches of the oil and gas industry. At yearend, there were 1,064 oil and gasfields containing 33,824 wells capable of producing oil and/or gas.

Leasing by major oil companies in the Louisiana Gulf Coast continued to be active. Smaller companies continued to be active and to concentrate on farm-outs as evidenced by the onshore new-field discoveries in 1962.

Four sales of public lands were held in 1962—two by the U.S. Department of the Interior under provisions of the "Interim Agreement" and two by the State of Louisiana. In the first lease sale, held March 13 and 16, the Department of the Interior offered 3.6 million acres of submerged lands, largest lease sale in history, and accepted bids amounting to $445.8 million on 412 of the 781 Louisiana offshore tracts offered. In the second sale, held October 9, the Department of the Interior accepted bids amounting to $43.9 million for 9 of the 19 tracts offered in zone 2 (area between 3 and 10 miles from shoreline). This raised the escrow fund for the disputed control of the area to $458 million.

In the first State sale, held April 11, of mineral leases on State-owned lands and water bottoms, including zone 1 (area 3 miles seaward from present shoreline), the State Mineral Board accepted bids amounting to $11.4 million. From the sale held October 26, the State Mineral Board accepted $2.7 million for 30,608 acres of offshore leases and $2.9 million for 42,772 acres of inland leases. The State also moved to speed up drilling on State-owned lands by issuing 166 letters of demand, calling for drilling or relinquishing undeveloped leases.

Exploration and Reserves.—Louisiana scored impressive gains in oil and gas reserves as the industry maintained a relatively high discovery rate. Statewide drilling of 4,927 wells (development and exploratory) was 25 percent more than in 1961 and proved 61 percent productive; Statewide drilling of 1,080 exploratory wells (slightly more than in 1961) proved 25 percent productive. Inland drilling of 871 exploratory wells proved 21 percent productive and opened 26 fields—5 oil and 2 gas discoveries in north Louisiana and 9 oil and 10 gas discoveries in south Louisiana.

Despite continued depressed oil markets, regulatory uncertainties, and higher cost of drilling, the offshore oil interests staged a remarkable record by drilling 209 exploratory wells (42 percent productive) and by discovering 14 fields (4 oil and 10 gas), compared with 7 fields in 1961. New drilling techniques were developed and used to extend drilling to deeper water in tidelands. The Shell Oil Co. Blue Water rig represented a major breakthrough for drilling in deeper water. The rig is a floating platform moored in position by eight 11-ton anchors in a mile-wide circle. Combined with the stabilized platform is a unique remote-control apparatus that permits coupling the rig with the ocean floor and well. The Blue Water rig, capable of drilling in any depth of water, was tested at a site 50 miles south of Grand Isle in 285 feet of water—deepest water ever attempted for drilling operations in the Gulf of Mexico.

Two other floating-type drilling rigs were designed by Offshore Co., Baton Rouge, and Equitable Shipyard, Madisonville. Offshore's floating unit (320 by 70 feet) featured a unique positioning system, operated by a gyroscopic principle, which actuates propellers in bow and stern to stabilize the ship against winds and tides. Drilling may be over the side or through the hull.

TABLE 5.—Oil and gas well drilling and total crew-weeks spent in geophysical oil and gas prospecting in 1962, by parishes

Location	Drilling							Geophysical, crew-weeks		
	Proved field wells			Exploratory wells			Total	Gravity meter method	Reflection seismograph method	Total
	Oil	Gas	Dry	Oil	Gas	Dry				
Parish:										
Acadia	14	8	18	7	6	23	76		68	68
Allen			2		2	3	7		17	17
Ascension	5	3	3		1	2	14		12	12
Assumption		2	8			9	19		41	41
Avoyelles	5		3	2		30	40	14	38	52
Beauregard	5		12	1		16	34		92	92
Bienville		3	6			3	12		29	29
Bossier	48	13	15	1	3	10	90		15	15
Caddo	453	2	34	2		9	500		1	1
Calcasieu	18	6	20	2	2	10	58		44	44
Caldwell		2	2			9	13		19	19
Cameron	41	12	32	5	6	22	118		202	202
Catahoula	45		67	3		44	159			
Claiborne	10	2	6		1		19		7	7
Concordia	30		43	3		47	123		3	3
De Soto	50	12	37	2	1	9	111		3	3
East Baton Rouge	1					2	3		23	23
East Carroll			1				1			
East Feliciana						1	1		36	36
Evangeline	9	1	5		1	3	19		5	5
Franklin	5		5	1		5	16		14	14
Grant	3		2			14	19		6	6
Iberia	20	5	11	5	2	3	46		151	151
Iberville	38	1	9	2		7	57		14	14
Jackson		2	3		2	11	18		23	23
Jefferson	72	4	20	2	4	11	113		100	100
Jefferson Davis	3	4	8		5	12	32		65	65
Lafayette	2	3	2	1	2	3	13		39	39
Lafourche	151	18	42	2	6	30	249		191	191
La Salle	35		56	2		18	111		1	1
Lincoln		18	12		5	5	40		14	14
Livingston	2		2			1	5		4	4
Madison			1			2	3		18	18
Morehouse		25	2			1	28			
Natchitoches	1		3			10	14		34	34
Orleans		2	1				3		5	5
Ouachita		104	7		1	2	114		3	3
Plaquemines	189	35	38	2	3	23	290		55	55
Pointe Coupee	2		3	1		2	8		1	1
Rapides	9		9	2			20		32	32
Red River	5		6			3	14			
Richland	7		4			2	13		4	4
Sabine	223	1	213	17	3	24	481		48	48
St. Bernard	12	5	1			3	21		98	98
St. Charles	10	1	6		2	5	24		18	18
St. Helena						1	1		11	11
St. James		2	7			1	10		13	13
St. John the Baptist		1	5	2		2	10		11	11
St. Landry	15	3	12	2	4	17	53		39	39
St. Martin	23	4	17	3	3	17	67		83	83
St. Mary	48	16	19	1	9	12	105		136	136
St. Tammany						2	2		29	29
Tensas	39	1	25	5	1	14	85		15	15
Terrebonne	147	47	51		3	37	285		306	306
Union	1	157	14		2	7	181		7	7
Vermilion	12	9	32	6	15	47	121		192	192
Vernon						9	9		78	78
Washington									5	5
Webster	16	6	15	2	1	3	43		7	7
West Baton Rouge									1	1
Winn	53		58	1		70	182		40	40
West Feliciana									20	20
Total:										
1962	1,877	540	1,035	87	96	688	4,323	14	2,586	2,600
1961	1,347	445	696	95	108	721	3,412	180	2,941	3,121

See footnotes at end of table.

TABLE 5.—Oil and gas well drilling and total crew-weeks spent in geophysical oil and gas prospecting in 1962, by parishes—Continued

Location	Drilling							Geophysical, crew-weeks		
	Proved field wells			Exploratory wells			Total	Gravity meter method	Reflection seismograph method	Total
	Oil	Gas	Dry	Oil	Gas	Dry				
Offshore:										
Bay Marchand	65	6	8	1	1	3	84			
Breton, Sound	2	1	3	1		2	9		2	2
Cameron, East	1	8	2		4	9	24	17	32	49
Cameron, West	2	9	1	1	9	20	42	19	33	52
Chandeleur Sound	1	1				1	3		24	24
Delta, West	48	6	15	6	4	9	88	6	27	33
Eugene Island	10	1	7	1	3	10	32	24	30	54
Grand Isle	25	7	9	6	1	10	58	7	10	17
Main Pass	19		4	8	3	7	41	2	23	25
Marsh Island, South	5	3		2	8	12	30	11	47	58
Pelto, South	7		1	4		1	13		6	6
Ship Shoal	8	2	5	6	2	11	34	21	44	65
South Pass	49	7	8	3	2	4	73		21	21
Timbalier, South	19		2	4		6	31	6	37	43
Vermilion		16	2		8	16	42	19	34	53
Total:										
1962	261	67	67	43	45	121	604	132	370	502
1961	285	49	64	20	41	82	541	62	472	534
Grand total:										
1962	2,138	607	1,102	130	141	809	4,927	146	2,956	3,102
1961	1,632	494	760	115	149	803	3,953	242	3,413	3,655

Source: International Oil Scouts Association. International Oil and Gas Development. Austin, Tex., v. 32, 1962.

The world's largest offshore submersible drilling rig was built at a cost of $6.25 million by Avondale Shipyards for Kerr-McGee Oil Industries, Inc. The rig, capable of drilling in water up to 175 feet deep, is built in the shape of an equilateral triangle with 388-foot sides, and is supported by three 180-foot columns which rest on footings each measuring 74 feet long, 70 feet wide, and 20 feet deep.

Forrest Oil Corp. was credited with the first discovery well on offshore leases acquired in the March sale of the Department of the Interior. The discovery well (No. 1 Outer Continental Shelf lease 0900) in block 225, West Cameron area, was completed as a dual-zone gas well. Daily potentials were 4.2 million cubic feet of gas and 25 barrels of condensate from perforations at 8,603 to 8,608 feet and 2 million cubic feet of gas and 50 barrels of condensate from perforations at 5,898 to 5,903 feet. The well was shut in pending pipeline connections.

Gulf Oil Corp. also was successful in discovering oil in its first exploratory test on offshore leases purchased March 1962 from the Department of the Interior. This discovery well (block 41, West Delta area), completed in a zone 11,500 feet deep, tested 348 barrels of oil daily; two other oil zones and three gas zones also were found productive. The well was drilled from a mobile unit. A permanent platform will be built for drilling additional wells and to accommodate producing facilities.

Probably the most significant well drilled in Louisiana's Gulf Coast in 1962 was the Tennessee Gas Transmission Co. No. 1 OCS–1146 well in block 245, Vermilion area. It was drilled 87 miles from the nearest land in 126 feet of water and uncovered 128 feet, net, of gas productive sand at a total depth of 11,350 feet. Drilling was

accomplished by use of the Universal Drilling Co. *Mr. Louis* drilling barge.

Offshore production again comprised about 31 percent of the State's oil (crude oil and field condensate) output. Enthusiasm in the tidelands continued because these areas were considered promising for development of domestic oil and gas supplies.

According to The Oil and Gas Journal, 35.8 million feet of hole was drilled in the State during the year, or 22 percent more than in 1961. The number of drilling rigs operating offshore averaged 59 in 1962 and 56 in 1961; for the entire State, the average number was 261 in 1962 and 275 in 1961.

For the first time in several years, the southwest district (area onshore west of Atchafalaya River) received more exploratory drilling than the southeast district. This shift was attributed to concentrated drilling in Avoyelles Parish in search of shallow Eocene production. Formations of Cretaceous and Eocene ages also received special attention in the middle and northern parishes. There has been an active drilling program across central Louisiana in search of oil and gas production from Cretaceous rocks. These rocks are producing in Texas and geological conditions across central Louisiana are favorable for similar production. However, no commercial production has yet been discovered.

A particularly important dry hole was drilled by Shell Oil Co. on State Lease 3748 onshore in St. Bernard Parish. This well, drilled to a depth of 16,847 feet, may be the deepest stratigraphic test hole in south Louisiana. Presumably, it reached the Mooringsport formation (Lower Cretaceous) at total depth.

In north Louisiana, both oil and gas completions increased during 1962. This gain may be attributed to more development drilling at Caddo-Pine Island (Upper Cretaceous chalk), Monroe (Gas Rock), and Pendleton-Many (Upper Cretaceous chalk).

A Bureau of Mines study [3] of 14 water injection projects in oilfields of north Louisiana indicates that estimates of oil recovery, based on initial oil in place, average 22 percent by primary producing methods and 14 percent by pressure-maintenance or secondary-recovery methods, or 36 percent for the total.

Proved recoverable reserves of crude petroleum, natural gas, and natural gas liquids in Louisiana reached a new high despite increased withdrawals of each. Much of the increase in reserves came from extensions and revisions of previous estimates involving pools and fields discovered before 1962. State petroleum reserves increased by 155 million barrels, largest gain in the Nation, to a record total of 5,087 million barrels (16 percent of the Nation's total oil reserves). About 23 percent of the crude petroleum reserve was offshore, compared with 32 percent in 1961. Natural gas reserves increased 5.9 trillion cubic feet (Nation's net increase was 6 trillion cubic feet) to a record total of 71.9 trillion cubic feet (26 percent of U.S. total). Natural gas liquids reserve increased 204 million barrels (78 percent of

[3] Meadows, Paul, M. E. Hawkins, L. K. Weaver, and O. W. Jones. Engineering Study of Water Injection in 14 Oil Reservoirs of North Louisiana. BuMines Rept. of Inv. 5914, 1962, 143 pp.

U.S. net increase) to a record total of 1,698 million barrels (23 percent of U.S. total).

TABLE 6.—Crude petroleum, natural gas, and natural gas liquids production and addition to reserves [1]

Year	Crude petroleum (million barrels)		Natural gas (billion cubic feet)		Natural gas liquids (million barrels)	
	Production	Net additions to reserves	Production	Net additions to reserves	Production	Net additions to reserves
1953	257	202	1,294	3,007	23	100
1954	247	202	1,399	2,341	23	71
1955	271	294	1,680	5,636	26	52
1956	299	420	1,886	2,618	26	79
1957	330	182	2,079	6,382	26	4
1958	314	186	2,452	3,676	28	177
1959	363	616	2,670	4,742	33	162
1960	401	125	2,988	3,532	35	75
1961	425	146	3,272	2,643	41	61
1962	[2] 483	155	[1] 3,470	5,906	45	204

[1] Total proved reserves by Dec. 31, 1962 were as follows: Crude petroleum, 5,087 million barrels; natural gas, 71,935 billion cubic feet; natural gas liquids, 1,698 million barrels.
[2] Preliminary figure.

Source: Reserve figures based on American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural Gas Liquids, and Natural gas, v. 8-17, 1953-62. Production figures Bureau of Mines.

Carbon Black.—Output of carbon black from natural gas and petroleum distillates gained about 4 percent. The product was mainly used as an additive in rubber manufacturing.

Natural Gas.—Marketed production of natural gas continued a strong upward trend for the 17th consecutive year, and Louisiana retained second position in the United States as a supplier of natural gas. National demand for gas as a fuel for heating and power and as a raw material for petrochemicals grew rapidly. Offshore pipeline construction was continued to provide market outlets for added gas reserves.

The Federal Power Commission awarded Tennessee Gas Transmission Co. and its subsidiary, Midwestern Gas Transmission Co., authority to sell 180.4 million cubic feet of additional gas daily in the peak 1962–63 winter season and future peak periods. The decision permits the company to proceed with its construction projects and also adds to the amount of additional gas Tennessee has been selling under temporary authorization. The company's pipeline system delivers Texas and Louisiana gas to 100 utilities in 14 States.

Five gas transmission pipelines were constructed in the State during the year. Texas Gas Transmission Corp. laid 52 miles of 20-inch, 16-inch, and 8-inch line from Bay Round to Morgan City. Franklin Gas Co., Houston, Tex., laid 35 miles of 26-inch line from Cow Island in Vermilion Parish to Jennings in Jefferson Davis Parish. Texas Eastern Transmission Corp. expanded its gas delivery capacity by 225 million cubic feet daily.

United Gas Pipeline Co. completed a 57-mile, 36-inch pipeline from Bastian Bay Field, Plaquemines Parish, to connect with the company's main trunkline system at Lirette, Terrebonne Parish.

Bastian Bay is one of the world's largest gasfields and has 11 to 16 productive gas sands present, the deepest being 16,000 feet. The new pipeline, largest in Louisiana, is all under water and serves to deliver the huge gas supply to other major gas transmission systems which distribute the fuel to eastern markets.

TABLE 7.—Carbon black production

Year	Million pounds	Year	Million pounds
1953–57 (average)	464	1960	631
1958	503	1961	583
1959	599	1962	608

TABLE 8.—Natural gas data

(Million cubic feet)

Year	Withdrawals [1]			Marketed production [2]	Value at wells (thousands)	Disposition	
	From gas wells	From oil wells	Total			Repressuring	Vented and wasted [3]
1953–57 (average)	1,533,400	414,000	1,947,400	1,667,620	$173,666	202,311	77,469
1958	2,223,000	505,000	2,728,000	2,451,587	316,255	220,616	55,797
1959	2,442,000	514,000	2,956,000	2,670,271	411,222	186,599	99,130
1960	2,691,000	622,000	3,313,000	2,988,414	511,019	219,411	105,145
1961	2,930,100	640,700	3,570,800	3,271,857	611,837	201,989	96,954
1962	3,124,000	730,000	3,854,000	3,525,456	694,515	221,167	107,377

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas in pipelines.
[3] Partly estimated. Includes direct waste on producing properties and residue blown to the air.

The industry had two underground gas storage projects in Louisiana in 1962, one active and one planned. South Louisiana Production Co. operated a gas storage reservoir in Holly field, De Soto Parish; total storage capacity (1.5 trillion cubic feet) of the reservoir represented 1 trillion cubic feet "working" storage and a half trillion cubic feet "cushion" storage. Southdown Production Co. was planning gas storage in the Old Grand Cane field, also in De Soto Parish. The plan calls for storing gas from several fields in the Grand Cane reservoir during the low-demand season and withdrawal of gas as required by the company's pipeline serving central Louisiana areas.

Natural Gas Liquids.—Louisiana again held second position in the Nation as a producer of natural gas liquids, and registered the second largest increase in daily processing capacity. New plants and expansions added in 1962 raised the State's daily gas-processing capacity from 10.05 billion cubic feet to 10.92 billion cubic feet.

Natural gasoline and cycle products were recovered by 108 gasoline plants and 16 recycling plants (101 gasoline, 16 recycling in 1961) in 31 parishes. Increased output of total condensable liquids was attributed mainly to a gain in natural gas produced and processed. As long-distance gas pipelines increased in number and capacity, demand for the State's natural gas supplies increased in proportion and required additional gas-processing capacity. The resulting gain in liquid recovery totals had an appreciable impact on fuels markets.

TABLE 9.—Natural gas liquids production
(Thousand gallons and thousand dollars)

Year	Natural gasoline and cycle products		LP gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	732,377	$59,052	302,202	$12,842	1,034,579	$71,894
1958	783,099	50,371	410,869	21,435	1,193,968	71,806
1959	846,110	60,295	540,046	25,877	1,386,156	86,172
1960	875,567	66,214	606,023	28,147	1,481,590	94,361
1961	931,176	61,714	806,559	33,214	1,737,735	94,928
1962	1,010,137	74,726	862,772	29,037	1,872,909	103,76

Output of condensable liquids gained about 8 percent and represented about 46 percent LP gases and 54 percent natural gasoline—about the same proportion as in 1961. In recent years more LP gas has been consumed for chemical and fuel uses and less for blending into motor fuels at refineries. A fast-growing market for tractor fuel and crop drying was developing in agriculture.

To provide for rapid development and marketing of new gas supplies, the industry continued constructing vast facilities for processing natural gas and for recovering, delivering, and storing the plant liquids.

Five plants were completed or expanded and added approximately 1 billion cubic feet per day of gas-processing capacity. In Jefferson Davis Parish, two plants were put in operation; namely, Pan American Petroleum Corp.'s plant to process gas from the South Thornwell field, which has a capacity of 70 million cubic feet per day, and Phillips Petroleum Co.'s Rollover plant to process gas from offshore wells. The Rollover plant, designed to process 140 million cubic feet of gas daily and recover 53,000 gallons of products, is the newest type of processing plant opened in south Louisiana. Products are shipped by railroad, barge, and truck; processed gas is moved by long-distance pipelines to eastern seaboard markets. In Terrebonne Parish, Placid Oil Co. completed its Chauvin plant with a capacity of 100 million cubic feet daily to process gas from the Lapeyrous field. In St. Landry Parish, South Louisiana Production Co. completed a plant with a capacity of 40 million cubic feet per day. In St. Bernard Parish, Shell Oil Co. put on stream its Ysclosky gas-processing plant on the new Mississippi River-Gulf Outlet Channel. The plant is designed to extract about 10,000 barrels of liquids from 650 million cubic feet of gas daily from fields in lower Plaquemines Parish, including the big Bastian Bay field. In addition to these five plants, Shell Oil Co. installed a portable plant in Cameron Parish, and Pan American Petroleum Corp. installed a portable plant in the Sentell field, Caddo Parish.

Three gas-processing plants were shut down. These were the Bell Oil Corp. North Elton plant, Allen Parish, the Sunray Mid-Continent Oil Co. DeQuincy plant, Calcasieu Parish, and the United Gas Pipe Line Co. Vivian plant, Caddo Parish.

To facilitate delivery of large volumes of plant liquid (LP gas) to eastern markets, the Dixie Pipeline Co. system was completed from Baytown, Tex., through Louisiana to Raleigh, N.C. This line, owned

by 8 companies, is 1,080 miles long, ranges in diameter from 12 to 8 inches, and has an initial delivery capacity of 65,000 barrels daily. In the Louisiana section, pump stations and terminals are provided at points near Lake Charles, Lafayette, and Baton Rouge; storage is provided in salt dome caverns near Lafayette and Baton Rouge; several feeder lines supply the line directly from plants. One of these feeder lines is Humble Pipeline Co.'s 11-mile, 6-inch line from the Baton Rouge refinery to a connecting point near Baker.

Total capacity of underground storage for natural gas liquids was reported by The Oil and Gas Journal as 7.8 million barrels. These facilities consisted of salt dome caverns operated by nine companies in seven parishes. Total capacity for ethylene storage, also in salt dome caverns, was reported as 1.1 million barrels.

Petroleum.—The petroleum industry in Louisiana established a production record of 483 million barrels in 1962, the second highest in the Nation. The gain of nearly 14 percent over the 1961 figure came from new discoveries, both offshore and onshore.

To balance production with indicated demand, the State Conservation Commission adjusted petroleum allowables. Daily allowables, based on the Commission's formula, advanced from approximately 1,139,000 barrels at the first of the year to a peak of 1,216,000 barrels for the November–December period—largest allowable in the State's history.

Secondary-recovery projects (water, gas, or other injections) accounted for 44 million barrels of petroleum, or 9 percent of the 1962 production.

According to a survey,[4] Louisiana had 8,785 oil wells classified as "stripper" wells. For 1961, stripper wells represented 36 percent of total oil wells, but only 2.7 percent of the annual production and 3.2 percent of the State's recoverable oil reserves. Thus, normal production decline from stripper wells was not expected to affect appreciably the State's productive capacity and reserves in the immediate future.

TABLE 10.—Crude petroleum production
(Thousand barrels and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	280,703	$841,831	1961	424,962	$1,338,160
1958	313,891	1,023,517	1962 [1]	483,101	1,521,274
1959	362,666	1,145,569			
1960	400,832	1,258,138	1902–62	6,425,149	15,765,282

[1] Preliminary figures.

A 104-mile, 20-inch pipeline from Ostrica, La., completed in November 1962 by Cal-Ky Pipeline Co., will supply crude oil to the new Standard Oil Co. of Kentucky refinery near Pascagoula, Miss. This line, longest underwater pipeline in the United States, will be extended 50 miles to connect the California Co. 600-well Bay Marchand field in Lafourche Parish. This field is expected to supply about 75 percent of the refinery's needs.

[4] Interstate Oil Compact Commission. National Stripper Well Survey, January 1, 1962. Oklahoma City, Okla., October 1962.

TABLE 11.—Crude petroleum production, indicated demand, and stocks, in 1962, by months

(Thousand barrels)

Month	Production	Indicated demand	Stocks (end of month)	Month	Production	Indicated demand	Stocks (end of month)
January	39,859	39,237	20,382	September	40,728	39,688	22,827
February	36,800	36,480	20,702	October	43,001	43,069	22,759
March	40,931	39,702	21,931	November	41,862	42,305	22,316
April	39,718	37,846	23,803	December	43,708	43,401	22,623
May	39,199	40,372	22,630				
June	37,897	38,428	22,099	Total:			
July	39,254	39,621	21,732	1962	483,101	480,238	----------
August	40,144	40,089	21,787	1961	424,962	424,766	----------

TABLE 12.—Number of producing oil wells and average production per well

Year	Number of producing wells Dec. 31	Average production per well per day (barrels)	Year	Number of producing wells Dec. 31	Average production per well per day (barrels)
1953–57 (average)	18,370	50.3	1960	24,682	44.8
1958	23,070	38.1	1961	24,740	47.1
1959	23,468	42.7	1962 [1]	26,382	51.8

[1] Preliminary figures.

Refineries and Petrochemicals.—At the end of 1962, there were 14 petroleum refineries (1 partly active) in Louisiana. The crude oil capacity (barrels per day) was as follows: Operating, 822,050; standby, 8,500; and building, none. Cracking and reforming gasoline capacity (barrels daily) was as follows: Operating 276,585; shutdown, 5,000; and building, none.

Crude oil runs to refinery stills totaled 272 million barrels (about 6 percent more than in 1961) and represented about 56 percent of the State's annual production of crude oil.

Tenneco Oil Co. (formerly Bay Petroleum Co.) decreased crude oil capacity at the Chalmette refinery from 50,000 to 48,000 barrels daily.

The Clark Oil & Refining Corp. refinery at Marrero, Jefferson Parish, was acquired by Tenneco Oil Co. and started processing 3,000 barrels of middle distillates daily.

Murphy Corp. (formerly Ingram Oil & Refining Co.) at Meraux, St. Bernard Parish, increased crude oil capacity (barrels daily) from 21,000 to 22,000; fluid catalytic cracking capacity from 6,500 to 7,500; polymerization capacity from 370 to 580; and recycle catalytic cracking capacity from 1,300 to 1,700.

Chemoil Corp. plans to build a 40,000-barrel-per-day refinery between New Orleans and Baton Rouge were pending at yearend.

At its Lake Charles refinery, Cities Service Petroleum Co. approached completion of the first hydrocracking plant in the free world—designed to convert residual oils with high sulfur content into a synthetic sweet crude oil equivalent. The process plant, known as an H-oil unit, with a designed initial capacity of 2,500 barrels of oil daily, reacts heavy, high-boiling-point residuum with hydrogen in presence of an active catalyst to remove sulfur, nitrogen, and organo-

metallic compounds, simultaneously upgrading the stock treated. The treated oil then is used as feedstock for processing into lighter petroleum products such as gasoline, heating oil, and diesel fuel. Crude oil capacity of the Cities Service refinery was reduced from 190,700 to 190,000 barrels daily without change of output.

Evangeline Refining Co. at Jennings added a 600-barrel-per-day catalytic reforming unit.

TABLE 13.—Production of crude petroleum by districts and selected fields

(Thousand barrels)

District and field [1]	1961	1962 [2]	District and field [1]	1961	1962 [2]
Gulf coast:			Gulf coast—Continued		
Onshore: [3]			Onshore [3]—Continued		
Anse la Butte	1,565	1,600	West Bay	5,945	7,432
Avery Island	2,985	2,714	West Cote Blanche	4,559	5,446
Bateman Lake	3,538	2,835	West Lake Verret	1,328	1,515
Bay de Chene	2,272	2,541	Other	134,115	153,752
Bay St. Elaine	5,596	8,198			
Bayou Sale	5,387	6,677	Total onshore	307,361	345,803
Bully Camp	1,529	1,572			
Caillou Island	17,634	19,828	Offshore: [3]		
Cox Bay	1,932	1,976	Bay Marchand	16,723	17,233
Delta Farms	2,885	3,018	Eugene Island	8,066	9,823
Duck Lake	2,765	3,031	Grand Isle	11,227	13,743
East and West White Lake	782	1,752	Main Pass Block 69	7,227	8,592
Erath	6,745	4,809	Ship Shoal	3,771	3,478
Garden Island	2,865	3,209	South Pass Block 27	8,980	11,585
Golden Meadow	2,363	2,493	Vermilion		2,154
Grand Bay	3,568	5,613	West Delta Block	11,131	14,043
Hackberry	4,413	5,791	Other	3,400	7,214
Lafitte	3,563	4,236			
Lake Barre	6,438	9,476	Total offshore	70,525	87,865
Lake Pelto	4,551	4,607			
Lake Salvador	2,238	2,800	Total Gulf Coast	377,886	433,668
Lake Washington	10,618	10,621			
Leeville	3,794	3,997	Northern:		
Little Lake	1,940	2,082	Caddo	5,638	5,704
Main Pass Block 35	3,967	4,126	Cotton Valley	6,678	3,430
Paradis	2,701	2,453	Delhi	5,097	4,670
Quarantine Bay	4,678	5,241	Haynesville	2,220	2,513
Romere Pass	3,086	2,925	Lake St. John	2,923	2,046
South Pass Block 24	15,671	16,578	Pendelton		2,022
Timbalier Bay	11,860	14,124	Sligo	1,434	2,305
Valentine	1,726	1,803	Other Northern	23,086	26,743
Venice	4,599	4,574			
Vinton	1,622	1,801	Total Northern	47,076	49,433
Weeks Island	9,538	8,557			
			Total Louisiana	424,962	483,101

[1] Breakdown for individual fields from The Oil and Gas Journal.
[2] Preliminary figures.
[3] Some fields include onshore and offshore.

The Manufacturing Chemists' Association reported that petrochemical industry outlays in 1961 totaled about $202 million (6.4 percent of U.S. total) in Louisiana—making it second to Texas for chemical project expenditures in the Nation. For the first time chemical companies led petroleum companies in number of plant constructions, both new and planned, in 1962. According to a petrochemical survey by the Oil and Gas Journal (September 3, 1962), 75 projects were under construction or planned (93 in 1961) in the United States, and of these, 9 were in Louisiana. Emphasis on the new projects was directed toward ammonia, polyolefins, olefins, and aromatics. In addition to these constructions, announcements were made that E. I. du Pont de Nemours & Co., Inc., planned a $20 million chemical plant

near Laplace, St. John the Baptist Parish, to produce adiponitrile, a basic chemical for nylon; Monochem planned to expand its holdings at Geismar; and Continental Oil Co. planned an olefin plant adjacent to its new alpha alcohol plant at Lake Charles. Continental's plant will produce about 5 million pounds of alpha olefins per year from ethylene for use in detergents and plastics.

Louisiana chemical producers completed or were constructing nine projects (new plants and expansions) and announced plans for seven new projects.

TABLE 14.—Crude petroleum production and estimated reserves in Louisiana offshore area

(Thousand barrels)

Offshore area	Number of wells		1961	1962		
	1961	1962	Crude petroleum	Crude petroleum	Cumulative total	Estimated reserve
Bay Marchand: Block 2 [1] [2]	414	497	16,723	17,233	79,517	220,483
Belle Isle [2]	56	63	1,397	1,549	9,346	25,654
Caillou Island [1] [2]	551	580	17,634	19,828	197,184	102,816
Eugene Island:						
Block 18	56	59	2,764	2,704	11,922	28,078
Block 32	29	31	945	979	8,097	16,903
Block 45		10		541	2,887	8,113
Block 100	20	10	1,111	1,009	2,129	17,871
Block 110	16	[3]	461			
Block 126 [1]	90	88	3,248	3,633	27,595	97,405
Block 128	50	47	2,054	1,938	11,047	28,953
Block 188	18	16	927	806	3,628	11,372
Block 208	39	38	1,325	1,548	3,123	31,877
Grand Isle:						
Block 16	131	165	5,516	7,176	21,864	43,136
Block 18	40	35	1,951	1,805	16,791	23,209
Block 47	68	85	3,760	4,762	18,552	41,448
Block 69 [1]		207		8,592	61,276	138,724
Lake Washington [1] [2]	373	435	10,618	10,621	84,441	215,559
Main Pass:						
Block 46	6	[3]	368			
Block 69 [1]	188	[3]	7,227			
Ship Shoal:						
Block 28	4	12	563	670	1,234	8,766
Block 107	24	37	866	1,926	2,792	22,208
Block 154	40	38	1,483	1,552	9,212	30,788
Block 176	16	23	859	1,027	2,568	9,432
South Pass:						
Block 24 [1] [2]	546	571	15,671	16,578	174,867	325,133
Block 27 [1]	255	331	8,980	11,585	41,667	269,333
South Pelto: Block 20		16		572	1,178	8,822
Tiger Shoal	12	23	513	949	1,707	7,293
Timbalier Bay [1] [2]	366	390	11,860	14,124	82,551	217,449
South Timbalier: Block 131	12	32	517	693	2,267	9,733
Vermilion:						
Block 14	13	31	940	1,769	2,916	29,084
Block 120	[3]	10	[3]	385	1,804	8,196
West Cameron:						
Block 45	36	38	985	984	4,614	20,386
Block 192	40	41	550	510	1,524	18,476
West Delta:						
Block 24	9	11	416	471	988	7,012
Block 30 [1]	209	289	8,809	12,046	43,331	156,669
Block 53 [2]	12	15	798	464	6,450	15,550
Total	3,739	4,274	131,839	151,029	941,069	2,215,931

[1] Estimated ultimate recovery of 100 million barrels or more.
[2] Combined onshore and offshore.
[3] Not reported.

Source: The Oil and Gas Journal. V. 60, Jan. 28, 1963, pp. 173–174.

At Lake Charles, Calcasieu Parish, Ancon Chemical Co. (a joint venture between Continental Oil Co. and Ansul Chemical Corp. of Marinette, Wis.) completed a $1 million plant to produce 60 million pounds of methyl chloride annually. The chemical is used to manufacture butyl rubber, tetramethyl lead, silicones, methyl cellulose, and ammonia compounds. Output will be distributed by Ansul Chemical Co.

Cities Service Petroleum Co., at its Lake Charles refinery, completed a propylene unit and started constructing a $12 million plant to produce 35,000 tons of butyl rubber annually. Isobutylene feedstock will be supplied by the Cities Service refinery, and the rubber output will be marketed by Columbian Carbon Co. Columbian Carbon Co., now a subsidiary of Cities Service, operated carbon black plants in North Bend and Eunice, La., and is in partnership with other petrochemical producers in the gulf coast region. Most of the Cities Service petrochemical operations were placed under the management of Columbian Carbon Co.

Hercules Powder Co. completed a second plant at its Lake Charles site to produce 60 million pounds of high-density polyethylene or polypropylene per year. These chemicals will be used to manufacture film, automobile seat covers, webbing, and molded plastic items.

Pittsburgh Plate Glass Co. (formerly Columbia-Southern Chemical Co. at Lake Charles) completed at its Lake Charles plant a 15,000-ton-per-year unit to produce isopropyl percarbonate.

Calumet Refining Co. at Princeton increased vacuum distillation charge from 2,050 to 4,500 barrels daily and lubricating oil production from 1,100 to 1,750 barrels daily.

Humble Oil & Refining Co. at Baton Rouge increased crude oil capacity (barrels daily) from 397,000 to 404,500, vacuum distillation from 139,500 to 141,600, and recycle catalytic cracking from 60,000 to 64,000; catalytic reforming was decreased from 42,000 to 38,000 barrels daily, and wax hydrogen treating from 1,760 to 800. Asphalt production was increased from 11,000 to 12,300 barrels daily, and an $8 million delayed coking unit was scheduled for completion in 1963 and will produce 1,000 tons of petroleum coke daily.

Shell Oil Co. at Norco increased crude oil capacity from 107,000 to 120,000 barrels daily and asphalt production from 1,840 to 3,500 barrels daily.

During the year, total capacity of Louisiana refineries gained 17,980 barrels daily for crude oil charge and a significant 3,000 barrels daily for asphalt production, according to The Oil and Gas Journal.

To facilitate delivery of petroleum products from gulf coast refineries to southeastern and eastern seaboard markets, nine oil companies organized the Colonial Pipeline Co.—largest products pipeline in the Nation. The $360 million line consists of 1,600 miles of main line and 1,000 miles of spur lines ranging from 30 to 36 inches in diameter and extends from Houston, Tex., through Louisiana to New York City. Two of the 20 pump stations are located at Lake Charles and Baton Rouge. Designed delivery capacity of the line is 600,000 barrels of fuels daily (diesel fuel, fuel oil, kerosine, and gasoline); completion was scheduled for the fall of 1963.

At Shreveport, Universal Oil Products Co. completed a $4.2 million expansion to its Caddo Parish plant, which manufactures special catalysts for petroleum refinery processes.

A considerable number of the new plants and expansions are situated in the gulf coast area from Brownsville, Tex., to New Orleans and Baton Rouge, La. Leading petrochemical producers in this area justified expansion of the industry on the gulf coast by consideration of the following: Nearby and readily available supply of raw materials from refineries and gasfields; plentiful supply of cheap natural gas for fuel; ample supplies of fresh water, sulfur, salt, and lime; and ready access to water transportation for the plant products by either oceangoing tanker or river barge. Also, many of these plants are dependent on other local plants for interchange of raw materials and byproducts.

American Cyanamid Co. at Avondale, Jefferson Parish, was constructing a new facility at its Fortier plant to produce 40 million pounds of methyl methacrylate monomer annually. The monomer, to be manufactured from the company's own hydrocyanic acid, will be converted into plastics and artificial fibers. Plant completion was scheduled in two stages, the first in mid-1964. The company also completed a $3 million addition to its anhydrous ammonia plant at the same site. Present output includes 100 million pounds per year of acrylonitrile, 150 tons daily of ammonia, and large quantities of hydrocyanic acid, acetylene, and ammonium sulfate—all from natural gas.

Dow Chemical Co. at Plaquemine, Iberville Parish, completed a second polyolefin unit to produce polyethylene and polypropylene. The new $6 million facility employs about 60 more workers and brings Dow's total investment in Louisiana to $110 million.

At Geismar, Ascension Parish, U.S. Rubber Co. and the Borden Co. completed a $50 million three-plant petrochemical complex. The jointly owned first plant, known as Monochem, Inc., will produce annually 80 million pounds of acetylene and 150 million pounds of vinyl chloride. This output will be used by two individually owned plants to manufacture a variety of chemical products.

Naugatuck Chemical Division of U.S. Rubber Co. was planning a multimillion dollar chemical plant to adjoin Monochem, Inc., at Geismar. The plant, scheduled for completion in 1963, will produce about 32 million pounds annually at Flexzone, a synthetic rubber.

Allied Chemical Corp. and Union Texas Petroleum Division were planning a $40 to $60 million petrochemical plant, also at the Geismar site. The plant, scheduled for completion in 1964, will produce olefins and aromatics for further processing by Allied Chemical Corp. Feedstock will be supplied by the adjoining Union Texas gas-processing plant.

At its Baton Rouge refinery, Humble Oil & Refining Co. completed a $4 million facility (Aldox project) to produce 30 million pounds yearly of oxo-alcohols. Announcements also were made by Humble for an $8 million coking unit, and by Reynolds Metals Co. for a $2.5 million plant to calcine coke, both to be constructed at the Baton Rouge refinery. Reynolds will use the calcined coke to make electrodes for use in aluminum reduction plants.

NONMETALS

Alumina.—Kaiser Aluminum & Chemical Corp. produced alumina at its Gramercy and North Baton Rouge plants. The metallurgical alumina from these two plants was then transported downstream to the firm's aluminum works at Chalmette for reduction to primary aluminum.

Barite.—Crude barite, imported from Arkansas, Missouri, and foreign countries, was ground in Louisiana for use as weighting material in oil well drilling fluids. Three grinding plants operated at New Orleans and one at Lake Charles. Output of ground barite was slightly less than in 1961, although footage drilled for oil and gas gained about 22 percent.

Cement.—Portland cement production at three plants gained about 20 percent and was attributed mainly to recovery in construction, as indicated by increased value of construction contracts awarded (table 4). Both residential and nonresidential construction exhibited appreciable recovery in 1962.

Oklahoma Cement Co. announced plans for a plant on the Michoud Canal, New Orleans, to have an annual capacity of 1.5 million barrels. Jahncke Services, Inc., will supply the plant with oystershell.

Clays.—There was an overall slight decline in miscellaneous clay produced. Clay used for cement gained about 19 percent, but was offset by losses in brick and lightweight aggregate outputs. The losses in brick and lightweight aggregate were attributed to lagging use of this type of construction material during the year. About 165,000 tons of local clay was used to manufacture heavy clay products at 11 brick plants in 10 parishes. Lightweight aggregate was produced at Alexandria, Rapides Parish, Erwinville, Point Coupee Parish, and north of Shreveport, Caddo Parish.

TABLE 15.—Shipments of portland cement to Louisiana consumers

Year	Louisiana (thousand barrels)	Change, percent	
		In Louisiana	In United States
1953–57 (average)	7,097		
1958	8,048	+6	+6
1959	8,908	+11	+9
1960	8,007	−10	−7
1961	7,865	−2	+3
1962	8,875	+13	+3

TABLE 16.—Miscellaneous clay sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average) [1]	681	$786	1960	749	$749
1958 [1]	755	755	1961	645	645
1959 [1]	904	904	1962	638	641

[1] Excludes bentonite.

The Louisiana Geological Survey mapped a new bentonite deposit about 6 miles south of Homer in Claiborne Parish.[5] The mineral also has been mined in Lincoln Parish, but the newly found deposit is more extensive. Estimated reserves were reported as 712,000 short tons covering 72 acres.

Gypsum.—Winn Rock, Inc., Winn Parish, mined crude gypsum for a retarder in portland cement; output was about 7 percent greater than in 1961. National Gypsum Co. at Westwego and U.S. Gypsum Co. and Bestwall Gypsum Co. at New Orleans calcined imported crude gypsum and manufactured plaster, lath, and wallboard.

Lime.—Lime production declined slightly. About 66 percent of the total production (calcined and regenerated) was used by chemical plants, 32 percent by paper plants, and 2 percent by the building trade and agriculture. Shell was calcined to lime by one paper plant, two chemical plants, and two open-market lime plants; regenerated lime was produced at six paper plants. Lime producers for the open market were U.S. Gypsum Co. at New Orleans and Pelican State Lime Co. at Morgan City.

Nitrogen Compounds.—Air Reduction Sales Co. operated its air separation plant at the old Ronaldson Airport near Baton Rouge. The plant has a daily production capacity of 30 tons of liquid oxygen, nitrogen, and argon for industrial uses.

Salt.—Output of salt gained about 11 percent, owing to increased consumption of brine and rock salt by chemical plants. Five salt companies produced evaporated and/or rock salt; brine was produced by six chemical companies.

Responding to the growing demand for a variety of chemicals from salt, Morton Chemical Co. completed a multimillion dollar plant at Geismar in Ascension Parish to supply chlorine and other chemicals from salt to the huge petrochemical complex at that site.

Louisiana's tremendous reserves of salt in its many salt domes, both inland and coastal, attracted attention of salt producers especially because of favorable orientation of these reserves to water transportation and to markets. At the Cote Blanche Island salt dome in St. Mary Parish, Carey Salt Co. (with Monsanto Chemical Co.) continued shaft-sinking operations. The dome, at a depth of 564 feet, is in Cote Blanche Bay and is bounded on the north by the Intercoastal Canal. Planned rate of production is 300 tons of rock salt per hour.

At the Belle Isle salt dome, also in St. Mary Parish, Cargill, Inc., a Minneapolis farm products firm and salt distributor, began operating its new mine equipped with a crusher and hoisting system capable of producing 400,000 tons of crushed salt annually. After sufficient salt is removed, crushing, processing, screening, and storage will be moved underground to assure ideal working conditions in constant temperature and humidity, unhampered by weather or other outside influences. To sink the shaft (deepest in Louisiana), Cargill engineers devised a plan to freeze a vertical core of the earth 40 feet in diameter, enabling the 16-foot-diameter shaft to penetrate through 200 feet of muddy earth without collapse. Walls of the shaft were then

[5] Durham, C. O., Jr., and others. St. John's Bentonite Report, Claiborne Parish, Louisiana. Louisiana Geol. Survey, Folio Series 2, October 1962.

TABLE 17.—Salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953-57 (average)	3,375	$14,467	1960	4,792	$21,959
1958	3,442	18,960	1961	4,722	23,357
1959	4,807	20,918	1962	5,248	27,407

TABLE 18.—Salt production, by types

(Thousand short tons and thousand dollars)

Type	1959		1960		1961		1962	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Evaporated salt	168	$4,279	191	$4,737	196	$4,430	246	$6,298
Rock salt	1,601	10,959	1,730	12,097	1,770	12,884	2,004	13,531
Brine	3,038	5,680	2,871	5,125	2,756	6,043	2,998	7,578

lined with reinforced concrete as work progressed. At the surface, salt moves by conveyor from the shaft to a screening plant and then directly to barges. Truck and rail haulage to Southern, Eastern, and Midwestern States also will be utilized. At present, the salt is barged over a canal system to Port Allen on the Mississippi River, and is thence shipped up the Mississippi River waterways to Northern States as return cargo for grain barge tows. Markets supplied are principally municipal street deicing, meat packing, chemicals, refrigeration, and animal feed mixers.

Cargill, Inc., now has salt warehouses in Minneapolis, Minn., Omaha, Nebr., Kansas City, Mo., St. Louis, Mo., Davenport, Iowa, and LaSalle, Ill., and is building a new warehouse in Chicago, Ill. Estimated reserve of salt at Belle Isle is about 18 billion tons. Chemical analyses on salt retrieved from the shaft show 99 percent sodium chloride.

In 1962, the Avery Island mine and refinery, Iberia Parish, celebrated the 100th anniversary of rock salt discovery in North America. Open-pit mining of the Avery Island dome supplied the Confederacy with vital salt during the Civil War. In 1899, International Salt conducted salt operations on the island and sank the shaft to start the famous mine that exists today. The company was driving a slope to a lower level in the mine to make additional salt reserves readily available.

Sand and Gravel.—Production of 12 million tons of sand and gravel, about the same as in 1961, reflected little change in demand for building and paving. Washed sand and gravel was 11.8 million tons, or 98 percent of the total. Sand use was as follows: Building sand, 52 percent; paving sand, 45 percent; other construction and fill sand, 3 percent. Gravel use was as follows: Paving gravel, 53 percent; building gravel, 45 percent; and other construction and fill gravel, 2 percent. There were 117 commercial producers of sand and gravel in 24 parishes.

TABLE 19.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	9,516	$11,731	219	$101	9,735	$11,832
1958	14,610	16,982	451	137	15,061	17,119
1959	15,505	19,898	547	213	16,052	20,111
1960	13,935	18,990	384	116	14,319	19,106
1961	11,783	14,729	259	104	12,042	14,833
1962	11,701	14,682	339	135	12,040	14,817

TABLE 20.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,134	$1,997	2,065	$1,932
Paving	1,905	1,905	1,802	1,680
Fill	174	91	(1)	(1)
Other [2]	22	20	117	93
Total	4,235	4,013	3,984	3,705
Gravel:				
Building	3,466	4,527	3,382	4,749
Paving	3,783	5,833	4,163	6,028
Fill	(3)	(3)	(3)	(3)
Other [4]	299	356	172	200
Total	7,548	10,716	7,717	10,977
Total sand and gravel	11,783	14,729	11,701	14,682
Government-and-contractor operations:				
Gravel:				
Building	157	63	245	98
Paving	102	41	94	37
Total	259	104	339	135
Grand total	12,042	14,833	12,040	14,817

[1] Included in "Other" commercial sand.
[2] Includes fill (1962), filtration, blast, and other construction and industrial sands.
[3] Included in "Other" commercial gravel.
[4] Includes railroad ballast, fill, and other construction gravel (1962).

TABLE 21.—Sand and gravel production in 1962, by parishes

Parish	Short tons	Value	Parish	Short tons	Value
Bossier	75,000	$30,000	Red River	60,091	$122,362
Caddo	142,617	286,635	St. Tammany	577,299	360,098
Catahoula	387,452	612,304	Tangipahoa	447,686	326,282
East Baton Rouge	649,004	546,295	Washington	605,073	492,126
Lincoln	245,261	98,104	West Feliciana	55,512	105,948
Livingston	113,831	123,553	Other parishes [1]	7,561,398	10,181,364
Ouachita	473,517	784,459			
Rapides	646,058	747,810	Total	12,039,799	14,817,340

[1] Includes Allen, Beauregard, East Feliciana, Evangeline, Grant, Jefferson Davis, Lafayette, LaSalle, Madison, St. Helena, Webster, and undistributed amounts from various parishes, combined to avoid disclosing individual company confidential data.

Gifford-Hill and Company, Inc., at Shreveport, completed a $180,000 expansion of operations for sand production and concrete products.

Stone.—Most of the stone produced was shell (clam and oyster). A small amount of miscellaneous stone was produced in Winn Parish for road surfacing and concrete. Lacking an adequate supply of stone, Louisiana relied on shell as a substitute. Shell used for concrete aggregate and road construction was 72 percent; as cement raw material, 17 percent; burned to lime, 10 percent; and as paint filler, rubber filler, and mineral food, 1 percent. Total output of shell was 23 percent greater than in 1961.

Winn Rock, Inc., at Winnfield, installed an asphalt-filler plant which utilized purchased silica sand as the base material.

Sulfur.—Shipments of Frasch sulfur declined about 4 percent from the record shipments of 1961 because of lower stockpile requirements at mines and terminals. Recovered sulfur was produced from refinery operations at Lake Charles and Baton Rouge. Domestic sales by the entire industry increased about 5 percent, with higher tonnages going to every sector of the sulfur market, including fertilizer, chemical, pigments, and petroleum industries.

TABLE 22.—Sulfur produced and shipped from Frasch mines

(Thousand long tons and thousand dollars)

Year	Production	Shipments		Year	Production	Shipments	
		Quantity	Value			Quantity	Value
1953–57 (average)	2,057	1,986	$52,544	1960	2,264	2,256	$52,639
1958	2,055	2,028	47,651	1961	2,608	2,352	55,164
1959	2,035	2,252	52,779	1962	2,363	2,262	49,772

Competitive production of recovered sulfur (from natural gas) from western Canada increased, but Canadian producers made only negligible inroads in the Upper Midwestern States because of the freight advantage held by U.S. producers who barge sulfur up the Mississippi River.

Exports for the year, to countries outside North America, gained 5 percent despite strong competition from Mexican, Canadian, and French producers. These sales abroad were handled by Sulphur Export Corp. (Sulexco), owned by Freeport and three other domestic producers.

Louisiana's Frasch process sulfur came from the Freeport Sulphur Co. mines at Grande Ecaille, Garden Island Bay, Lake Pelto, and Grand Isle (offshore). A 1,500-foot extension was added to the Grand Isle offshore platform to bring the total length to 4,076 feet. The new extension will permit drilling 108 additional sulfur wells. The company's Chacahoula mine reached the end of commercial production in September. As customer preference for molten sulfur continued to grow, Freeport Sulphur Co. expanded its liquid distribution system. New transshipment terminals were established during the year at Nitro, W. Va., Baton Rouge, La., and Charleston, S.C., to supplement inland and coastal terminals already in existence. In Europe, terminals were being established by Sulexco at Immingham, England, and Rotterdam, Holland.

A wild gas-well fire from a stray gas pocket burned itself out after 33 hours at the Freeport Sulphur Co. Grand Isle mine. The flames destroyed the derrick of the movable rig but caused no injuries to workers.

METALS

Aluminum.—Kaiser completed a $6 million hydrogen fluoride and fluorocarbons plant at its Gramercy works. The plant is adjacent to the $1.4 million aluminum fluoride plant scheduled for completion in 1963 and will supply it with hydrogen fluoride. Hydrogen fluoride and fluorocarbons will be marketed. Hydrogen fluoride is used in producing or processing petroleum, stainless steel, glass, uranium, and other products. Fluorcarbons are used as refrigerants in air conditioners, refrigerators, and freezers, as propellants for aerosols, and in plastics manufacture.

Iron Ore.—The Louisiana Geological Survey investigated iron ore deposits in Claiborne and Union Parishes. The deposits, identified as siderite and limonite, are bedded deposits exposed in hillsides and are reported to be similar to deposits in east Texas. The report of the investigation, to be completed in 1963, will contain a map of the deposits and estimates of reserves of each type of ore.

REVIEW BY PARISHES

Minerals were produced in all but 1 of the State's 64 parishes. Mineral fuels were produced in 58 parishes; other minerals were produced in 40 parishes. Eight parishes reporting mineral production valued at over $100 million (seven in 1961) were: Plaquemines, $468 million; Terrebonne, $260 million; Lafourche, $246 million; St. Mary, $167 million; Cameron, $132 million; Vermilion, $117 million; Acadia, $104 million; and Iberia, $101 million. Four parishes reporting between $100 million and $50 million (same in 1961) were: Jefferson, $87 million; Jefferson Davis, $59 million; St. Landry, $58 million; and St. Martin, $57 million. Forty-one other parishes reported mineral production valued at more than $1 million.

Acadia.—Exploratory drilling of 36 wells for petroleum and natural gas proved 36 percent productive; 55 percent of the 40 development wells drilled were productive. About 68 crew-weeks were spent in geophysical prospecting. The parish ranked first in producing natural gas liquids; seven plants recovered the liquids, valued at $22.2 million.

The West Leleux gasfield was discovered.

TABLE 23.—Value of mineral production in Louisiana, by parishes [1]

Parish	1961 [2]	1962 [3]	Minerals produced in 1962 in order of value
Acadia	$100,944,908	$104,168,761	Petroleum, natural gas, natural gas liquids.
Allen	8,893,167	9,702,257	Petroleum, natural gas, natural gas liquids, sand and gravel.
Ascension	2,359,485	2,609,882	Petroleum, natural gas, salt.
Assumption	22,405,117	24,951,696	Petroleum, natural gas.
Avoyelles	1,789,364	1,933,841	Petroleum, natural gas liquids, natural gas.
Beauregard	15,989,936	17,453,567	Petroleum, natural gas, natural gas liquids, sand and gravel.

See footnotes at end of table.

TABLE 23.—Value of mineral production in Louisiana, by parishes[1]—Continued

Parish	1961 [2]	1962 [3]	Minerals produced in 1962 in order of value
Bienville	$8,831,894	$9,664,316	Natural gas, petroleum.
Bossier	35,340,674	40,823,182	Natural gas, petroleum, natural gas liquids, sand and gravel.
Caddo	32,346,459	35,600,770	Petroleum, natural gas, sand and gravel, natural gas liquids, clays.
Calcasieu	40,388,733	44,058,836	Petroleum, natural gas, cement, natural gas liquids lime, salt, clays.
Caldwell	1,042,791	1,135,639	Natural gas, petroleum.
Cameron	120,257,808	131,702,148	Natural gas, petroleum, natural gas liquids, salt.
Catahoula	5,854,680	7,119,331	Petroleum, sand and gravel, natural gas.
Claiborne	26,472,322	27,964,834	Petroleum, natural gas, natural gas liquids.
Concordia	13,201,763	14,880,875	Petroleum, natural gas.
De Soto	11,951,379	12,884,857	Natural gas, petroleum.
East Baton Rouge	12,215,303	15,429,795	Cement, petroleum, lime, sand and gravel, natural gas, natural gas liquids, clays.
East Feliciana	(4)	(4)	Sand and gravel.
Evangeline	10,970,816	11,872,862	Petroleum, natural gas, natural gas liquids, sand and gravel.
Franklin	2,236,350	2,537,324	Petroleum, natural gas.
Grant	(4)	(4)	Petroleum, sand and gravel.
Iberia	87,229,003	100,977,285	Petroleum, natural gas, salt, natural gas liquids, clays.
Iberville	28,121,844	31,871,650	Petroleum, salt, natural gas.
Jackson	197,419	218,583	Natural gas, petroleum.
Jefferson	80,469,151	87,472,778	Petroleum, natural gas, sulfur, shell, natural gas liquids.
Jefferson Davis	50,973,419	58,548,794	Natural gas, petroleum, natural gas liquids, sand and gravel.
Lafayette	9,104,576	10,119,074	Petroleum, natural gas, clays, sand and gravel.
Lafourche	220,202,970	245,715,502	Petroleum, natural gas, sulfur, natural gas liquids.
La Salle	17,497,273	19,811,767	Petroleum, natural gas, sand and gravel.
Lincoln	21,720,705	19,212,598	Natural gas, natural gas liquids, petroleum, sand and gravel, clays.
Livingston	227,234	307,977	Petroleum, sand and gravel, natural gas.
Madison	1,151,625	1,723,741	Do.
Morehouse	1,721,089	1,956,788	Natural gas, natural gas liquids, petroleum.
Natchitoches	311,033	353,917	Petroleum, clays, natural gas.
Orleans	(4)	(4)	Cement, lime, shell.
Ouachita	8,918,123	7,896,744	Natural gas, petroleum, sand and gravel, natural gas liquids, clays.
Plaquemines	420,356,969	467,931,843	Petroleum, natural gas, sulfur, natural gas liquids.
Pointe Coupee	7,064,135	7,796,749	Petroleum, natural gas, natural gas liquids, clays.
Rapides	1,985,041	1,689,231	Petroleum, sand and gravel, natural gas, clays.
Red River	1,043,735	1,162,657	Petroleum, sand and gravel, natural gas.
Richland	15,662,586	17,383,474	Petroleum, natural gas, natural gas liquids.
Sabine	1,465,854	1,663,481	Petroleum, natural gas.
St. Bernard	3,084,721	9,400,447	Natural gas liquids, petroleum, natural gas.
St. Charles	40,049,816	44,316,326	Petroleum, natural gas, natural gas liquids.
St. Helena	(4)	(4)	Sand and gravel.
St. James	4,030,875	4,538,523	Petroleum, natural gas, natural gas liquids.
St. John the Baptist	3,555,370	4,020,776	Petroleum, natural gas.
St. Landry	47,223,716	57,700,409	Petroleum, natural gas, natural gas liquids.
St. Martin	50,658,042	56,811,251	Petroleum, natural gas, salt, natural gas liquids.
St. Mary	148,103,879	167,492,971	Petroleum, natural gas, natural gas liquids, shell, lime.
St. Tammany	1,550,111	2,189,596	Shell, sand and gravel, natural gas, petroleum, clays.
Tangipahoa	543,084	393,070	Sand and gravel, petroleum, clays.
Tensas	15,110,312	16,346,035	Petroleum, natural gas, natural gas liquids.
Terrebonne	229,659,731	260,014,111	Petroleum, natural gas, sulfur, natural gas liquids.
Union	12,813,138	13,983,066	Natural gas, petroleum.
Vermilion	105,529,151	117,256,588	Natural gas, petroleum, natural gas liquids.
Vernon	3,077	3,477	Petroleum, natural gas.
Washington	(4)	(4)	Sand and gravel, lime.
Webster	31,217,975	34,141,626	Natural gas, petroleum, natural gas liquids, sand and gravel.
West Baton Rouge	1,260,893	1,460,857	Petroleum, natural gas, clays.
West Carroll	342,669	373,085	Natural gas.
West Feliciana	1,259,400	105,948	Sand and gravel.
Winn	5,511,654	5,889,225	Petroleum, salt, stone, gypsum, natural gas.
Undistributed	18,254,655	48,582,207	
Total	2,168,679,000	2,445,329,000	

[1] East Carroll not listed because no production was reported.
[2] Revised figures.
[3] Preliminary figures.
[4] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Ascension.—At Geismar, U.S. Rubber Co. and Borden Co. completed a $50 million three-plant petrochemical complex. The jointly owned first plant, known as Monochem, Inc., will produce annually 80 million pounds of acetylene and 150 million pounds of vinyl chloride. This output will be used by the two individually owned plants to manufacture a variety of chemical products.

Naugatuck Chemical Division of U.S. Rubber Co. was planning a multimillion dollar chemical plant to adjoin Monochem, Inc., at Geismar. The plant, scheduled for completion in 1963, will produce Flexzone, a synthetic rubber.

Allied Chemical Corp. and Union Texas Petroleum Division were planning a $40 to $60 million petrochemical plant, also at the Geismar site. The plant, scheduled for completion in 1964, will produce olefins and aromatics for further processing by Allied Chemical Corp. Feedstock will be supplied by the adjoining Union Texas gas-processing plant.

Avoyelles.—Exploratory drilling of 32 wells resulted in discovery of Middle Bayou oilfield. Natural gas liquids were recovered by the Eola plant of Anchor Gasoline Corp.

Beauregard.—Exploratory drilling of 17 wells in the parish resulted in discovery of Banister oilfield. Natural gas liquids were recovered at three plants.

Bossier.—Natural gas liquids were recovered at five gas-processing plants. Exploratory drilling of 14 wells resulted in discovery of the Scottsville gasfield.

Caddo.—The parish ranked first in total number of oil and gas wells drilled—500 wells in 1962 (340 in 1961). Natural gas liquids were recovered by four gas-processing plants. The Vivian plant of United Gas Pipe Line Co. was shut down.

Caddo Light Aggregate Co., Inc., a subsidiary of Bayou State Oil Corp., mined clay to manufacture lightweight aggregate at its plant northwest of Shreveport. Gifford-Hill and Company, Inc., at Shreveport, completed a $180,000 expansion of operations for sand production and concrete products.

At Shreveport, Universal Oil Products Co. completed a $4.2 million expansion to its Caddo Parish plant which manufactures special catalysts for petroleum refinery processes.

Calcasieu.—Lake Charles Industrial Complex, comprising over a dozen large plants built to facilitate production and processing of crude petroleum, natural gas, natural gas liquids, cement, sulfur, lime, and salt, was one of the most important in the State.

Ancon Chemical Co. (a joint venture between Continental Oil Co. and Ansul Chemical Corp. of Marinette, Wis.) completed a $1 million plant at Lake Charles to produce 60 million pounds of methyl chloride annually. Output will be distributed by Ansul Chemical Co.

Cities Service Petroleum Co. approached completion of the first hydrocracking plant at its Lake Charles refinery. The process, known as H-Oil, converts residual oils with high sulfur content into a synthetic sweet crude oil.

Cities Service also completed a propylene unit at its Lake Charles refinery, and began constructing a $12 million plant to produce ultimately 35,000 tons of butyl rubber annually. Isobutylene feedstock

will be supplied by the Cities Service refinery, and the rubber output will be marketed by Columbian Carbon Co. Columbian Carbon Co., now a subsidiary of Cities Service, operates carbon black plants in North Bend and Eunice, La., and is partners with other petrochemical producers in the gulf coast region. Most of the Cities Service petrochemical operations were placed under management of Columbian Carbon Co.

Hercules Powder Co. completed a second plant at its Lake Charles site to produce 60 million pounds of high-density polyethylene or polypropylene per year. These chemicals will be used to manufacture film, automobile seat covers, webbing, and molded plastic items.

Pittsburgh Plate Glass Co. completed a 15,000-ton-per-year isopropyl percarbonate unit at its Lake Charles plant.

The Calcasieu River and Pass, the State's second waterway capable of accommodating seagoing traffic, was being dredged for a deeper and wider channel to permit passage of larger tankers to the port of Lake Charles; also, the existing channel dimensions were to be extended 2.2 miles upstream to permit seagoing ships to reach the ore-grinding facilities of Lake Charles Harbor. Other new port facilities to be constructed at Lake Charles included a canal 6 miles long for industrial waterfront, a $1.8 million bulk-handling plant capable of berthing ships for exporting petroleum coke in 10,000-ton cargoes, and other wharfing and transit facilities.

The Calcasieu Industrial Board, created by the Port of Lake Charles and Calcasieu Parish Police Jury, contracted with a consulting firm to make a comprehensive economic and industrial study of the parish.

Cameron.—The parish ranked fifth in total value of mineral production and first in value of natural gas. Exploratory drilling in the offshore West Cameron area resulted in discovery of four gasfields.

Natural gas liquids were recovered at 11 gas-processing plants.

Catahoula.—Drilling of 47 exploratory wells resulted in 3 productive oil wells and opening of the Bryant Brake oilfield; development drilling resulted in 45 oil wells and 67 dry holes.

Claiborne.—Natural gas liquids were recovered at four gas-processing plants. Exploratory and development drilling resulted in 10 oil wells, 3 gas wells, and 6 dry holes.

De Soto.—Drilling of 111 wells (104 in 1961) proved 52 oil wells and 13 gas wells.

South Louisiana Production Co. started operating underground gas storage in the Holley field reservoir. Working capacity of the storage is 1 billion cubic feet. Another gas storage project was planned for the old Grand Cane field.

East Baton Rouge.—Construction of new facilities and expansion of existing facilities were reported in the Baton Rouge area, which contains one of the State's largest industrial complexes. Kaiser Aluminum & Chemical Corp. processed Jamaican bauxite into alumina at its North Baton Rouge plant.

At its Baton Rouge refinery, Humble Oil & Refining Co. completed a $4 million facility (Aldox project) to produce 30 million pounds yearly of oxo-alcohols. Humble announced plans for an $8 million coking unit, and Reynolds Metals Co. planned a $2.5 million plant to calcine coke; both plants were to be constructed at Humble's Baton

Rouge refinery. Reynolds will use the calcined coke to make electrodes for use in aluminum reduction plants.

Polymer Chemical Division, W. R. Grace & Co., produced polyethylene plastics. Copolymer Rubber & Chemical Corp. produced butadiene for conversion to styrene-butyl rubber.

Ethyl Corp. produced motor fuel additives.

Natural gas liquids were recovered at the Burtville plant of Shell Oil Co. Clay was mined by Acme Brick Co. to manufacture brick. Ideal Cement Co. produced portland cement, high-early-strength, and masonry cements from shell which was barged up the Mississippi River.

Evangeline.—Natural gas liquids were recovered at Ville Platte plant of Continental Oil Co. and at Mamou and Pine Prairie plants of Socony Mobil Oil Co.

Iberia.—The parish ranked first in salt production; about 40 percent of the State's output came from three large mines. Natural gas liquids were recovered at the Shell Oil Co. Weeks Island plant. Drilling of 10 exploratory wells proved 5 oil wells and 2 gas wells; drilling of 36 field wells proved 20 oil wells and 5 gas wells.

Iberville.—Dow Chemical Co. at Plaquemine completed a polyolefin unit. The new $6 million unit employed about 60 workers. Gulf States Utilities Co. started an expansion of its Sunshine plant to add 220,000 kilowatts of generator capacity.

Jefferson.—Freeport Sulphur Co. added a 1,500-foot extension to the Grand Isle offshore platform to bring the total length to 4,076 feet. The new extension will permit drilling 108 additional sulfur wells.

The parish ranked fifth in petroleum output, which was valued at $59 million. Natural gas liquids were recovered at two gas-processing plants. The Walkertown gasfield and Crown Point oilfield were discovered.

American Cyanamid Co. was constructing a new facility at its Fortier plant to produce 40 million pounds annually of methacrylate monomer. Plant completion was scheduled in two stages, the first in 1964. The company completed a $3 million addition to its anhydrous ammonia plant at the same site.

Tenneco Oil Co. reactivated the Clark Oil & Refining Corp. refinery at Marrero and started processing 3,000 barrels of middle distillates daily.

Jefferson Davis.—Exploratory drilling of 17 wells proved 5 gas wells and discovery of the Bayou Rogers gasfield.

Two processing plants were put in operation: Pan American Petroleum Corp.'s plant to process gas from the South Thornwell field, which has a capacity of 70 million cubic feet per day; and Phillips Petroleum Co.'s Rollover plant to process gas from offshore wells. The Rollover plant, which has a throughput capacity of 140 million cubic feet of gas daily and recovery of 53,000 gallons of products, was the newest processing plant in south Louisiana. Products are shipped by railroad, barge, and truck; processed gas is moved by long-distance pipelines to eastern seaboard markets. Two other gas-processing plants also operated in the parish.

Lafourche.—The parish ranked third in total value of minerals produced, second in crude oil produced, and fifth in natural gas output.

Extensive exploration for petroleum (191 crew-weeks) and drilling of 38 exploratory wells resulted in 8 productive wells but no new fields. Natural gas liquids were recovered at Lockport plant of Socony Mobil Oil Co. and Valentine plant of Texaco, Inc.

The Freeport Sulphur Co. Chacahoula mine reached the end of commercial production in September 1962.

Lincoln.—The parish, with three gas-processing plants, recovered natural gas liquids valued at $5 million. Ruston Brick Works mined clay at Ruston to manufacture brick.

Orleans.—New Orleans Public Service, Inc., completed its new 230,000-kilowatt generating unit at the Michoud station. The installation, estimated to cost over $24 million, will help meet power requirements of the reactivated Michoud plant of the National Aeronautic and Space Agency. Most of the barite ground in the State was from foreign ores and was processed in Orleans Parish by three companies. Alatex Construction Services, Inc., processed crude perlite from Western States into expanded perlite for use in acoustical plasters and concrete aggregate.

At New Orleans, U.S. Gypsum Co. manufactured building lime, quicklime, and hydrated lime at its new lime plant adjacent to the company's gypsum products plant and fronting on the Inner Harbor Industrial Canal. Bestwall Gypsum Co. operated its gypsum lath and plaster products plant near New Orleans.

Oklahoma Cement Co. planned a $12 million plant located on the Michoud Canal and designed to manufacture 1.5 million barrels of cement annually.

Ouachita.—Acme Brick Co. mined clay at Monroe to manufacture brick and tile. Natural gas liquids were recovered at the Calhoun plant of Arkansas Louisiana Chemical Corp. The Southwest Caderville gasfield was discovered.

Plaquemines.—Total value of mineral production in the parish, which is situated in the Mississippi River delta, increased from $420 million (revised) in 1961 to $468 million in 1962—the highest in the State. The parish ranked first in production of crude petroleum and sulfur and fourth in natural gas. Geophysical prospecting amounted to 55 crew-weeks. The parish ranked third in total number of oil and gas wells drilled, with 290 wells in 1962 (276 in 1961). Tiger Pass oilfield was discovered onshore; Breton Sound Block 53 oilfield and Main Pass Block 53 gasfield were discovered offshore. The parish had vast onshore and offshore reserves of petroleum and natural gas.

Natural gas liquids were recovered at nine gas-processing plants.

Rapides.—Five commercial sand and gravel producers operated in the parish. Clay was mined for producing lightweight aggregate by Louisiana Lightweight Aggregate Co. and for structural clay products by Acme Brick Co. Exploratory drilling proved two oil wells and opened LeCompte oilfield.

St. Bernard.—Natural gas liquids were recovered at three plants. Shell Oil Co. began operating its Ysclosky gas-processing plant on the new Mississippi River-Gulf Outlet Channel. The plant was designed to extract 10,000 barrels of liquid from 650 million cubic feet of gas daily from fields in Plaquemines Parish.

Main Pass Block 6 gasfield was discovered offshore.

Tenneco Oil Co. decreased crude oil capacity at its Chalmette refinery from 50,000 to 48,000 barrels daily.

Murphy Corp. increased crude oil capacity from 21,000 to 22,000 barrels per day and increased fluid cracking capacity from 6,500 to 7,500 barrels per day at its Meraux refinery.

The Chalmette aluminum works of Kaiser Aluminum & Chemical Corp. operated eight of nine potlines.

St. James.—At Gramercy, Kaiser Aluminum & Chemical Corp. completed a $6 million plant to produce hydrogen fluoride and fluorcarbons. The new plant will supply hydrogen fluoride to the adjacent $1.4 million aluminum fluoride plant scheduled for completion in 1963.

St. Landry.—The parish ranked third in recovery of natural gas liquids; four recovery plants operated in 1962. South Louisiana Production Co. completed a new gas-processing plant. The $1.5 million plant was designed to process up to 40 million cubic feet of gas daily to recover 50,000 gallons of liquids.

St. Mary.—The parish ranked fourth in total value of minerals and in petroleum production, and also produced appreciable quantities of natural gas, natural gas liquids, and shell.

Geophysical prospecting totaled 136 crew-weeks during the year. Southwest Belle Isle gasfield was discovered onshore, and Pass Fourchon gasfield was discovered offshore.

Two salt domes were being developed for salt production. At the Belle Isle dome, Cargill, Inc., a Minneapolis farm products firm, completed a 1,300-foot shaft and began operating; annual capacity of the mine was 400,000 tons of crushed rock salt. Cargill used barges to transport the salt to its grain terminal at Port Allen and up inland waterways. At Cote Blanche Island dome, Carey Salt Co. continued work on a 564-foot shaft.

Terrebonne.—The parish ranked second in total value of minerals produced, second in natural gas production, third in oil production, and fourth in number of wells drilled for exploration and development of petroleum and natural gas. Exploratory drilling resulted in discovery of St. Paul Bayou gasfield onshore; offshore discoveries were Ship Shoal Area Block 230 gasfield, Ship Shoal Area Block 208 oilfield, and South Pelto Block 23 oilfield.

Natural gas liquids were recovered at five plants—Shell Oil Co. (two plants), Texaco, Inc., Tidewater Oil Co., and at the Placid Oil Co. new Chauvin plant. The Chauvin plant has a throughput capacity of 100 million cubic feet of gas daily and was installed to process gas from the Lapeyrous field.

Freeport Sulphur Co. mined sulfur by the Frasch process from its Lake Pelto mine opened in 1960.

Vermilion.—The parish ranked third in value of natural gas and second in value of natural gas liquids produced. Exploratory drilling resulted in discovery of Milton gasfield onshore, and of Vermilion Block 115 and Vermilion Block 245 gasfields offshore.

Natural gas liquids were recovered at five gas processing plants. One of these plants (Cow Island) supplied mixed liquids by pipeline to the Goliad Corp. Riverside fractionator at Geismar on the

Mississippi River. At Geismar, the hydrocarbon components from the fractionator were supplied as feedstock to the petrochemical plants.

Webster.—The parish ranked fifth in value of natural gas liquids recovered. The liquids were recovered at Cotton Valley plant of Cotton Valley Operators and Bistineau plant of Arkansas-Louisiana Chemical Corp. Lime was produced at the Springhill plant of International Paper Co. for plant use.

Winn.—Extensive drilling of 182 wells (371 in 1961) proved 53 field-development oil wells and 1 exploratory oil well. No new fields were discovered.

Winn Rock, Inc., at Winnfield, mined about 7 percent more crude gypsum than in 1961. The firm also installed an asphalt-filler rock plant, but decided to use purchased silica sand for the base material.

The Mineral Industry of Maine

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Maine, for collecting information on all minerals except fuels.

By Joseph Krickich[1] and Mary E. Otte[2]

MINERAL production in Maine in 1962 totaled $14.9 million, a 4-percent decrease from the record high year, 1961. Decreased cement shipments and lower demand for architectural stone were the major contributing factors. The year, however, was marked by record high production of sand and gravel. Other significant developments were the continued exploration for metallic minerals and the virtual end of mica mining in the State. Knox County continued as the leading mineral-producing area.

Legislative and Government Programs.—The General Services Administration (GSA) discontinued purchases of strategic mica on June 7, marking the end of the purchase program. Sales of mica and beryl recovered at Maine mines to GSA purchase depots at Franklin, N.H., and Spruce Pine, N.C., were sharply affected.

TABLE 1.—Mineral production in Maine[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Beryllium concentrates---short tons	5	$3	(2)	(2)
Clays---thousand short tons	43	51	48	$63
Gem stones	(3)	20	(3)	25
Mica:				
Scrap---short tons	80	2	15	(4)
Sheet---pounds	5 9,680	88	2,017	16
Peat---short tons			3,050	47
Sand and gravel---thousand short tons	8,921	3,796	10,014	4,013
Stone---do	998	4,694	1,127	4,249
Value of items that cannot be disclosed: Cement, feldspar, and values indicated by footnote 2		6,961		6,534
Total		5 15,615		14,947

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Weight not recorded.
[4] Less than $500.
[5] Revised figure.

[1] Mineral specialist, Bureau of Mines, Pittsburgh, Pa.
[2] Statistical clerk, Bureau of Mines, Pittsburgh, Pa.

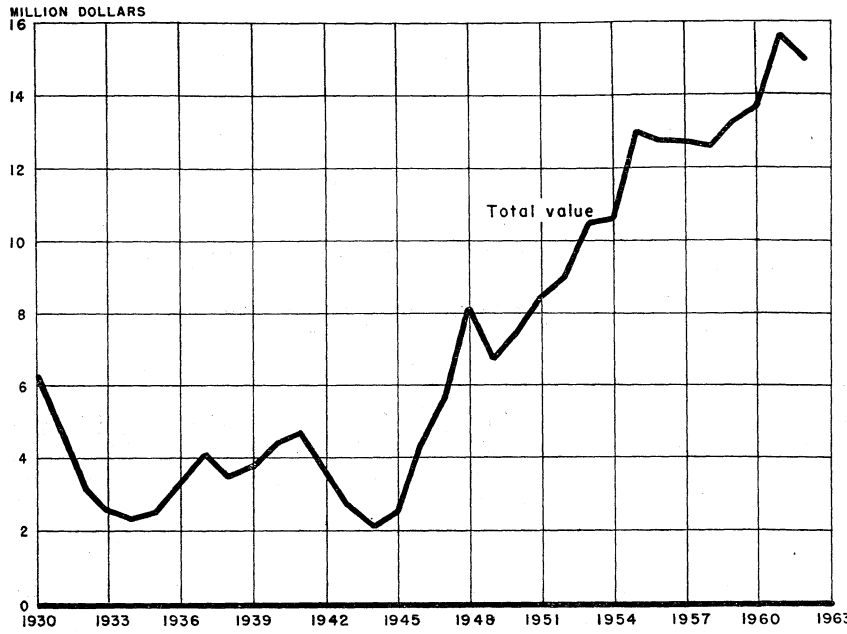

FIGURE 1.—Total value of mineral production in Maine, 1930–62.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Dragon Cement Co., Inc., Division of Martin Marietta Corp., was the only cement producer in Maine. Production and shipments of portland cement decreased slightly compared with 1961. Average value per barrel also decreased slightly. Stocks at yearend were slightly higher than 1961. Types I–II (general use) and type III (high-early strength) portland cements were produced. Shipments of masonry cements and average value per barrel also decreased. The principal raw material used at the plant was limestone quarried by the company. Purchased sand, gypsum, and iron ore also were used as cement raw materials. Shipments of portland and masonry cement were made to consumers in Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. Most of the portland cement was shipped in bulk; approximately one-fourth the tonnage was in paper bags. The principal consumers of portland cement, in decreasing order of size, were ready-mixed concrete companies, building supply dealers, and concrete product manufacturers. Most of the remainder was consumed by highway and other contractors.

Clays.—Output of clays increased 12 percent over that of 1961. Production consisted primarily of miscellaneous clay used in manufacturing building brick. A limited quantity of fire clay used for manufacturing pottery was reported. Eight clay pits—two in Androscoggin

County, four in Cumberland County, and one each in Hancock and York Counties were active.

Feldspar.—Output and value of crude feldspar continued to decline. A contributing factor in the decline of crude feldspar production was the unavailability of suitable material in the State. Production was reported from seven mines compared with nine in 1961. No production was reported from Androscoggin County. The average unit value for crude material remained at $6.00 per long ton. Crude feldspar was crushed or ground at West Paris, Oxford County. The grinding mill processed crude ore obtained from mines in Oxford County and from New Hampshire. The ground feldspar was sold mainly for ceramic uses and was shipped principally to consumers in Pennsylvania and Wisconsin. A limited quantity was exported to Canada. Sales of ground feldspar were slightly above 1961.

Gem Stones.—Mineral localities, consisting primarily of old mines and dumps, continued to attract thousands of gem and mineral collectors. Oxford County continued to be the chief collecting area. Included among the various minerals collected were actinolite, spodumene, beryl, tourmaline, and vesuvianite.

Lime.—Oxford Paper Co. at Rumford, Oxford County, recovered and used quicklime for manufacturing paper. The lime was regenerated and supplemented with purchased material. The company used fuel oil at its rotary kiln plant.

Mica.—Production of mica dropped sharply because the Federal Government ended its purchase of strategic sheet mica for the national stockpile on June 7, 1962. Output was the lowest since 1952 when the purchase program began. From 1952 to 1962, sales of Maine sheet mica, consisting of full trim and hand-cobbed converted to equivalent full trim, to GSA totaled over 141,000 pounds valued at $1.4 million. Purchases of sheet mica by GSA were limited to the first 6 months of 1962; none was reported sold to industry. Production was reported from five mines, four in Oxford County and one in Sagadahoc County. All sheet mica produced in the State was purchased by GSA depots at Franklin, N.H., and Spruce Pine, N.C. Limited quantities of scrap mica from undesignated locations were purchased by mica grinders.

Nitrogen Compounds.—Northern Chemical Industries, Searsport, Waldo County, produced anhydrous ammonia for use as a fertilizer component.

Peat.—Production of peat was reported for the first time since 1959. Output of moss peat came from Hancock and Washington Counties and was used chiefly as a soil conditioner.

Sand and Gravel.—Production of sand and gravel set a new record, rising to 10 million tons, 2 percent higher than the previous record high year, 1960. Output increased 12 percent over that of 1961. The major factor in the increase was the accelerated highway building and improvement program. Production of paving material by commercial producers and Government-and-contractor operations supplied 90 percent of the total output. Eighty-one percent of the total was produced by Government-and-contractor operations, compared with 75 percent in 1961. The Maine Highway Commission was the

largest producer in the State. Washed, screened, or otherwise prepared material comprised 58 percent of the commercial sand and gravel and 96 percent of the Government-and-contractor tonnage. Most of the commercial output was shipped to consumers by truck; the remainder was shipped by rail. Penobscot County replaced Cumberland as the leading sand and gravel producing county.

TABLE 2.—Sand and gravel sold by producers, by classes of operations and uses

Class of operation and use	1961		1962	
	Short tons	Value	Short tons	Value
Commercial operations:				
Sand:				
Structural	303,071	$249,739	230,128	$152,544
Paving	132,328	94,067	301,191	242,059
Engine	2,206	2,757	1,880	2,350
Fill	133,691	48,290	168,772	80,979
Other [1]	71,319	39,308	95,725	70,788
Total	642,615	434,161	797,696	548,720
Gravel:				
Structural	338,329	390,008	131,315	143,088
Paving	1,037,748	546,396	600,481	441,720
Railroad ballast	46,173	40,845	(2)	(2)
Fill	119,962	55,828	206,722	71,659
Other	89,944	46,181	[3] 123,103	[3] 64,402
Total	1,632,156	1,079,258	1,061,621	720,869
Total sand and gravel	2,274,771	1,513,419	1,859,317	1,269,589
Government-and-contractor operations:				
Sand:				
Structural	23,014	8,055		
Paving	618,234	230,039	1,673,224	559,326
Fill			13,076	4,577
Other	3,105	642		
Total	644,353	238,736	1,686,300	563,903
Gravel:				
Paving	6,001,098	2,043,841	6,467,885	2,179,845
Fill	340	110		
Total	6,001,438	2,043,951	6,467,885	2,179,845
Total sand and gravel	6,645,791	2,282,687	8,154,185	2,743,748
All operations:				
Sand	1,286,968	672,897	2,483,996	1,112,623
Gravel	7,633,594	3,123,209	7,529,506	2,900,714
Total	8,920,562	3,796,106	10,013,502	4,013,337

[1] Includes molding and other sand.
[2] Figure withheld to avoid disclosing individual company confidential data; included with other gravel.
[3] Includes railroad ballast and other gravel.

Stone.—Although output of stone increased 13 percent, value declined 9 percent, primarily because of decreased demand for dressed architectural stone and lower unit values for crushed material. Seventeen stone quarries were active; eight granite, six limestone, and one each for sandstone, slate, and miscellaneous stone. Dimension stone consisted of granite and slate. Dimension granite included rough and dressed monumental stone, rough and dressed construction and architectural stone, rubble, curbing and flagstone, and paving blocks. Slate was marketed largely as electrical slate and flagging. Crushed and broken stone, including sandstone, granite, and miscellaneous stone, was used mostly as concrete aggregate and roadstone. Lime-

stone was consumed for a variety of uses, but principally in making cement, for road material, paper manufacturing, and as agricultural stone (agstone). The leading stone-producing counties, in decreasing order of value, were Knox, Hancock, and York.

METALS

Interest continued in developing metallic mineral deposits in the State. Several exploration and development programs were conducted during 1962. In Hancock County, Blackhawk Mining, Ltd., explored for copper, zinc, and silver in the Blue Hill area. Exploration for copper and zinc by Penobscot Mining Corp. at Cape Rosier and Goose Falls Pond was discontinued. Roland F. Beers, Inc., drilled for nickel, copper, and cobalt deposits at the Harriman and Crawford Pond prospects near East Union in Knox County. Exploration by diamond drilling for possible beryllium deposits was conducted by the Bureau of Mines at Plumbago Mountain and Buckfield, both in Oxford County. The geology and manganese deposits of eastern Aroostook County were described.[3]

Beryllium Concentrates.—Output of beryllium concentrates was reported by one producer in Oxford County. The concentrates were sold through the GSA purchase depot at Franklin, N.H., and averaged 11.34 percent beryllium oxide.

REVIEW BY COUNTIES

The Maine State Highway Commission produced paving sand and gravel in all counties; output was obtained both by its own crews and by workers under contract. A small quantity of sand for fill was also mined. In addition, three municipalities in Androscoggin County, two in Penobscot County, and one each in Hancock and York Counties mined sand and gravel for local road and street maintenance. Penobscot and Aroostook Counties were the leading areas for the production of Government-and-contractor sand and gravel. A limited quantity of crushed granite and sand and gravel was produced under contract for Acadia National Park in Hancock County.

Androscoggin.—Output of commercial sand and gravel was reported from 11 operations mainly near Lewiston and Auburn. Most of the output was used for building and paving and as fill material. Two companies produced miscellaneous clay from open pits near Auburn for manufacturing building brick. Morin Brick Co., Auburn, made improvements at its local plant by adding sheds for drying brick. No crude feldspar was recovered from the LaFlamm and Phillips mines as reported in previous years.

Aroostook.—Sand and gravel was produced by Bull Bros., Presque Isle; Quint Bros., Hodgdon; and Lawrence Burleigh, Houlton. McKay Rock Products, Inc., Presque Isle, quarried limestone for concrete aggregate, roadstone, and railroad ballast.

Cumberland.—Granite used as roadstone and riprap was quarried near Portland by Cook & Co. During 1962, the company installed a new crusher. Blue Rock Quarry, Westbrook, produced stone for con-

[3] Pavlides, Louis. Geology and Manganese Deposits of the Maple and Hovey Mountains Area, Aroostook County, Maine. U.S. Geol. Survey Prof. Paper 362, 1962, 116 pp.

TABLE 3.—Value of mineral production in Maine, by counties

County	1961	1962	Minerals produced in 1962 in order of value
Androscoggin	(1)	(1)	Sand and gravel, clays.
Aroostook	$420,843	$663,131	Sand and gravel, stone.
Cumberland	1,287,395	816,861	Stone, sand and gravel, clays, gem stones.
Franklin	(1)	(1)	Sand and gravel.
Hancock	(1)	(1)	Stone, sand and gravel, peat, clays.
Kennebec	305,645	293,061	Sand and gravel, stone.
Knox	(1)	(1)	Cement, stone, sand and gravel.
Lincoln	(1)	62,709	Sand and gravel.
Oxford	(1)	199,514	Sand and gravel, feldspar, mica, beryllium concentrates, gem stones.
Penobscot	613,502	946,533	Sand and gravel.
Piscataquis	(1)	(1)	Stone, sand and gravel.
Sagadahoc	92,296	(1)	Sand and gravel, mica.
Somerset	160,352	198,953	Sand and gravel, stone.
Waldo	(1)	(1)	Stone, sand and gravel.
Washington	143,766	(1)	Sand and gravel, peat.
York	(1)	(1)	Stone, sand and gravel, gem stones.
Undistributed [2]	[3] 12,591,270	11,766,873	
Total	[3] 15,615,000	[4] 14,947,000	

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes value of some gem stones, sand and gravel (1962), and mica that cannot be assigned to specific counties; and values indicated by footnote 1.
[3] Revised figure.
[4] Data do not add because of rounding.

crete aggregate, roadstone, and riprap. Commercial producers of sand and gravel were Harry O. Crooker & Sons, Inc., Brunswick; Cumberland Sand & Gravel Co., Inc., and Maynard W. Robinson & Sons, both near Cumberland; P. E. Hamlin, Portland; Fred H. Jordan, South Portland; and Leroy S. Prout Sand & Gravel, Scarborough. Cumberland County continued to lead in clay production. Four companies mined miscellaneous clay from open pits for use in making brick—two near Gray, and one each near South Windham and North Yarmouth. Fred S. Liberty & Sons, North Yarmouth, installed a new beehive kiln.

Franklin.—Commercial sand and gravel used for building and paving was recovered from pits near Wilton and Weld. The West Farmington clay pit of Joseph Bonsaint was not operated.

Hancock.—Hancock County led in production of granite; output and value increased 32 and 42 percent, respectively. Dimension granite was quarried by three producers near Hall Quarry, Franklin, and Stonington, chiefly for use as rough and dressed architectural stone and dressed construction and monumental stone. Output of commercial sand and gravel increased compared with that of 1961. Most of the material was used in construction and for spreading on icy highways. Producers were Raymond F. Sargent, Inc., and Blue Hill Gravel Pit, both near Ellsworth; Harold MacQuinn, Inc., Bar Harbor; Alvin R. Whitten, Winter Harbor; and Byron P. Young, Gouldsboro. Stoneware clay recovered from a pit near East Blue Hill was used for making art pottery and dinnerware.

Kennebec.—Commercial producers of sand and gravel were H. E. Sargent, Inc., Stillwater; V. E. Dunn & Son, Augusta; and Calvin Rundstram, Gardiner. Limestone was produced by Blue Rock Quarry, Sidney, for concrete aggregate and roadstone.

Knox.—Dragon Cement Co., Inc., Division of Martin Marietta Corp. produced portland and masonry cement at Thomaston. The company utilized cement rock quarried nearby as the principal cement raw ma-

terial. Knox County continued to lead in production of stone. Limestone, crushed or broken principally for agstone, paper manufacture, and roadstone was produced by Rockland-Rockport Lime Co., Rockland, and Lime Products Corp., Union. The Lime Products Corp. made improvements by expanding the crushing and pulverizing equipment at its Union plant. Dimension granite was quarried by Hocking Granite Industries, Inc., Clark Island, mainly for use as dressed-construction and architectural, and curbing stone. Some granite for riprap also was produced. The only commercial producer of sand and gravel was C. R. Wallace & Son, Inc., Warren.

Lincoln.—Howard R. Wright produced building, paving, and fill gravel from a pit near Pemaquid Harbor.

Oxford.—Crude feldspar was recovered from seven mines. Bell Minerals Co., the leading producer, operated mines at Hebron and West Paris. The company also ground feldspar for ceramic uses, including electrical porcelain, sanitary tile, and pottery; for soaps and abrasives; and for metal polish. Mica mining activity decreased sharply during 1962. Sheet mica was recovered by producers from the Cliff, Wardwell, Wheeler, and Rich mines. Total output was sold to GSA purchase depots at Franklin, N.H., and Spruce Pine, N.C. Lester E. Wiley recovered hand-cobbed beryl as well as hand-cobbed mica from the Wardwell mine near Albany. Commercial sand and gravel was recovered from a pit near Norway by Donald E. Wood.

Penobscot.—Production of sand and gravel by commercial operations totaled 248,000 tons, a slight increase compared with 1961. Seven operations were active mainly near Lincoln and Hampden. Most of the output was used in highway construction.

Piscataquis.—Portland-Monson Slate Co. obtained slate by the block caving method from Nos. 2 and 4 underground mines at Monson. The slate was processed at the local finishing mill, mainly for use as heavy-switch gear panels and flagging. Some of the finished flagstone and electrical slate was exported to Canada.

Sagadahoc.—Building and paving commercial sand and gravel was recovered from pits near Bath and Topsham. Earl F. Williams sold full-trim mica from Trott Cove mine near Woolwich to GSA (Franklin, N.H.) purchase depot. No hand-cobbed beryl was recovered in the county as in previous years.

Somerset.—H. E. Sargent, Inc., produced crushed limestone for road material at a portable plant west of Newport. Output was utilized by the Maine State Highway Commission. Donald J. Gurney, Inc., produced and processed sand and gravel at its Smithfield plant.

Waldo.—Dimension granite for use as dressed architectural stone and curbing was quarried near Frankfort by Grenci & Ellis, Inc. Sandstone for road material was produced at a portable crusher by Bridge Construction Corp.

Washington.—Sand and gravel was recovered by commercial operations near Machias and East Machias.

York.—John Swenson Granite Co., Inc., quarried dimension granite for dressed architectural stone, and riprap granite from the Swenson Pink Quarry, Wells, and the Swenson Green Quarry, York. Commercial sand and gravel production totaled 243,000 tons. Producers were Abbott Bros., York; P. R. Boston, Inc., North Berwick; Lucien Bourque, Inc., Biddeford; Genest Concrete Works, Inc., Sanford; I. H. Fenderson, Saco; and Alphonse Marcuri, York Harbor. Miscellaneous clay for manufacturing building brick was produced by Morin & Sons Brick Manufacturing Co., Eliot.

The Mineral Industry of Maryland

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By N. A. Eilertsen [1] and Stephanie A. Dzienis [2]

MINERAL PRODUCTION continued to rise in value and reached a new high of $66.6 million in 1962. The increase was chiefly the result of greater output of stone, cement, and coal. Stone ranked first in value followed by cement, sand and gravel, and coal. Baltimore County led in value of mineral production followed in decreasing order by Carroll and Prince Georges Counties.

TABLE 1.—Mineral production in Maryland [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays thousand short tons	581	$997	593	$899
Coal (bituminous) do	757	2,868	821	3,168
Gem stones	(2)	3	(2)	3
Natural gas million cubic feet	3,578	973	2,472	667
Sand and gravel thousand short tons	12,404	16,894	12,762	16,816
Stone do	[3] 10,007	[3] 20,373	11,610	22,595
Value of items that cannot be disclosed: Cement (masonry and portland), diatomite (1962), lime, greensand marl, peat, potassium salts, talc and soapstone		[3] 20,750		22,481
Total		[3] 62,858		66,629

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Revised figure.

[1] Supervising mining engineer, Bureau of Mines, College Park, Md.
[2] Statistical clerk, Bureau of Mines, Pittsburgh, Pa.

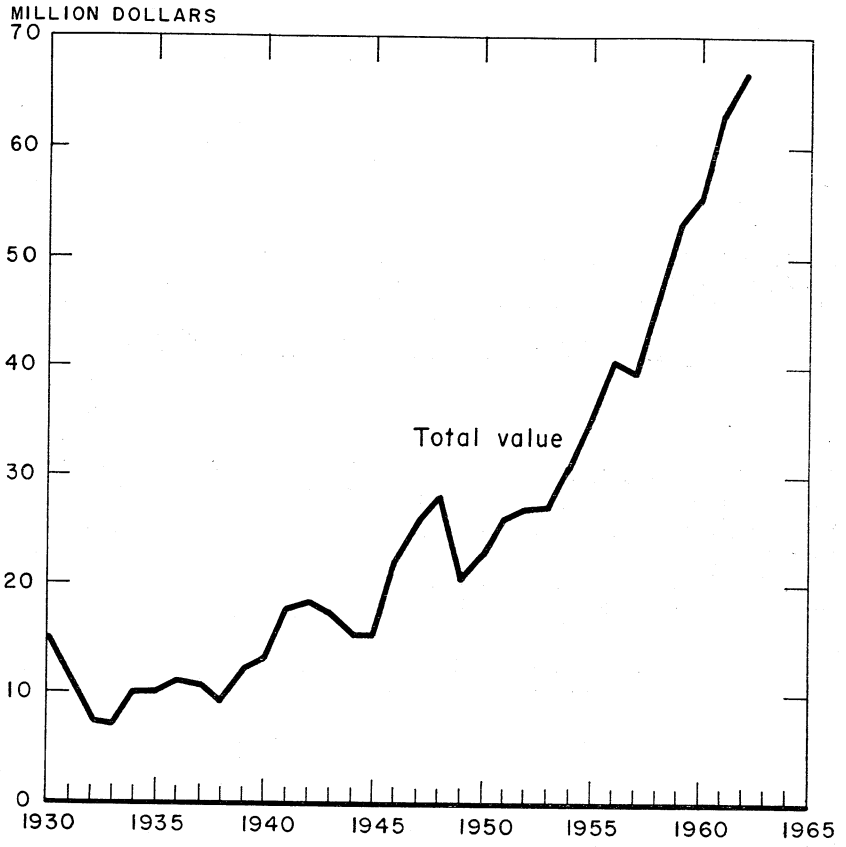

FIGURE 1.—Value of mineral production in Maryland, 1930–62.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Combined shipments of portland and masonry cement increased 9 percent, exceeding the loss sustained in 1961. Production of Portland cement was 79 percent of rated plant capacity. Non-air-entrained, general-use, and moderate-heat-type cements were the principal products. Two plants used a dry process and one a wet process. Electric power used for plant operation increased 5 percent over that of 1961, and most of the power was purchased.

In order of tonnage shipped, Maryland, Virginia, and the District of Columbia used most of the output of the three producing plants in Carroll, Frederick, and Washington Counties. Most of the cement used was for ready-mixed, followed by concrete products and highway construction.

Clays.—Total output of clays was 2 percent more in tonnage and 10 percent less in value than in 1961, partly because of reduced sales of

ball and fire clays and a small drop in the market value of miscellaneous clay. The output was mostly miscellaneous clay used mainly for manufacturing building brick and as raw material for cement. The production of ball clay dropped 17 percent and the output of fire clay decreased 28 percent. The principal uses remained stoneware, art pottery, and block firebrick.

Baltimore County was the only source of ball clay. Fire clay was produced in Allegany, Prince Georges, and Cecil Counties. The leading producers of miscellaneous clay were in Baltimore, Prince Georges, and Washington Counties.

Diatomite.—Diatomaceous earth was mined from a sedimentary formation in Calvert County.

Gem Stones.—Semiprecious minerals and ornamental natural stones were collected by hobbyists in several counties. Gemmy williamsite was found in Cecil County, and ornamental stone, conglomeratic marble, and quartz conglomerate were gathered in Frederick County.

Gypsum.—Crude imported gypsum was calcined at a plant near Baltimore.

Lime.—Production of lime was 13 percent less than in 1961. Output from three producers in Frederick County was marketed for agricultural use.

Marl, Greensand.—Granular and finely ground greensand marl was produced at Dunkirk, Calvert County, for soil conditioning purposes.

Perlite, Expanded.—A plant near Baltimore and one near Washington, D.C., expanded crude perlite obtained mainly from Colorado and New Mexico. The product was used chiefly for building plaster and concrete aggregate and as a filter aid. The market for expanded perlite was a little lower than in 1961.

Pigments.—A wide range of finished iron oxide pigments produced at a plant in Prince Georges County included natural yellow, brown, and red oxides, manufactured pure magnetic black oxide, raw and burnt sienna, raw and burnt umber, Vandyke brown, and Venetian red. Large quantities of titanium pigments were produced from imported ore at plants near Baltimore.

Potassium Salts.—Potassium sulfate was a byproduct of cement mill operations in Washington County, and output doubled that of 1961.

Sand and Gravel.—Production of sand and gravel increased 3 percent over the tonnage sold or used in 1961. Sales of commercial sand increased for almost all of the uses. Tonnage of sand for making glass rose 5 percent, and the quantity for grinding and polishing rose 7 percent.

The average value per ton of sand and gravel sold by producers in Maryland was $1.32 compared with $1.36 in 1961. The tonnage ratio of gravel to sand was 1:1.15. Commercial sand and gravel was produced in 12 counties. Prince Georges County led in output followed in decreasing order by Baltimore, Ann Arundel, and Cecil Counties. Government-and-contractor production of sand and gravel was reported from Baltimore, Talbot, Washington, and Worcester Counties.

TABLE 2.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Short tons	Value	Short tons	Value
Commercial operations:				
Sand:				
Structural	3,049	$3,898	3,366	$4,120
Paving	[1] 2,433	[1] 3,546	2,347	3,193
Fill	24	17	[2]	[2]
Other [3]	464	968	1,115	1,916
Total [4]	5,971	8,429	6,828	9,229
Gravel:				
Structural	2,080	3,820	1,914	3,568
Paving	2,276	3,200	2,028	2,719
Fill	859	715	703	354
Other	1,044	670	[5] 1,131	[5] 884
Total [4]	6,259	8,404	5,776	7,525
Total sand and gravel	12,230	16,833	12,604	16,754
Government-and-contractor operations:				
Sand	5	2	1	2
Gravel	169	59	157	60
Total sand and gravel [4]	174	61	158	62
All operations:				
Sand	5,976	8,431	6,829	9,231
Gravel	6,428	8,463	5,933	7,585
Total [4]	12,404	16,894	12,762	16,816

[1] Revised figure.
[2] Figure withheld to avoid disclosing individual company data; included with "Other."
[3] Includes glass, grinding and polishing, engine sand, railroad ballast (1962), other sand, and data indicated by footnote 2.
[4] Data may not add to total shown because of rounding.
[5] Includes railroad ballast.

Stone.—Output of stone increased 16 percent over 1961. The production of basalt and limestone increased 17 percent and 14 percent, respectively. Output of crushed granite used for concrete aggregate more than doubled. More limestone was marketed principally for concrete and roadstone and for agstone, whiting, coal dust, mineral food, stone sand, cement, and filler. Baltimore was the leading county in limestone production. Crushed oystershell, principally for poultry grit and lime, continued to be produced in two Maryland counties. Shipments from plants were by rail and truck. Production decreased 4 percent from that of 1961. A small quantity of dimension granite was produced in Cecil County.

Talc and Soapstone.—Production of talc and soapstone was slightly greater than that of 1961. A major portion of the crude output was ground and sold for asphalt filler, roofing, and miscellaneous uses. A small tonnage of crude material was sold directly to consumers in Ohio, Michigan, and Illinois mainly for use in foundry facings.

Vermiculite.—Crude vermiculite produced outside the State was exfoliated at a plant in Beaver Heights, Prince Georges County.

MINERAL FUELS

Coal (Bituminous).—Production was 8 percent more than in 1961 following a significant increase in output from underground mines in Garrett County. Coal from strip mines comprised 57 percent of the State total and from underground mines 43 percent. Average price for coal from strip mines was $3.32 per ton compared with $4.58 per ton for coal from underground mines. Average value of total production increased 7 cents per ton to $3.86. Garrett County produced 80 percent and Allegany County 20 percent of the State total output. Most of the coal was sold locally for heat and power.

Coal mining in the State was characterized by small nonmechanized underground mines and small contour strip mines on sloping hillsides. Of the underground production, 60 percent was cut by machine, 78 percent was power-drilled, and 25 percent was hand-loaded onto face or room conveyors. Mechanical cleaning was not used, but 17 percent of the total State output was crushed and sized.

Coke and Coal Chemicals.—Distribution of oven and beehive coke to blast furnace plants in Maryland amounted to 3,144,090 tons. By-product chemical materials production included ammonium sulfate, crude coal tar, and crude light oil and derivatives: (benzene, toluene, xylene), intermediate light oil, and naphthalene.

Natural Gas and Petroleum.—Production of natural gas continued in Garrett County at a steady rate from the Mountain Lake Park field and the Accident field.

Although there was no production of petroleum in Maryland, three refineries, having a combined daily capacity of 33,000 barrels of crude oil, operated continuously.

Peat.—Reed-sedge peat was produced from a bog in Kent County and marketed in bulk and in packages.

METALS

Copper.—Kennecott Copper Corp. operated its electrolytic copper refinery at Hawkins Point, Anne Arundel County, and produced refined high-purity copper from material originating at the company copper mines in Utah, Nevada, New Mexico, Arizona, and Chile. Operations were virtually continuous throughout the year.

Iron and Steel.—The Bethlehem Steel Co. produced basic and foundry pig iron at its Sparrows Point plant. Output of basic pig iron predominated. The iron ore consumed in the agglomerating plant, blast furnaces, and steel furnaces originated primarily in Venezuela and Canada; but Peru, Chile, and Sweden also supplied minor tonnages. Fluxes and other materials used, included limestone, dolomite, mill cinder and roll scale, flue dust, coke, anthracite coal, home and purchased scrap metal, home slag scrap and slag from open-hearth, basic oxygen, and Bessemer plants. The company announced a new $36 million program to produce a thin lightweight tin plate at its Sparrows Point plant. It would be processed by a cold-reduction mill, high-speed tinning line, a roll grinder, and a coil preparation line.

Titanium Pigments.—The Glidden Company's pigment plant at Hawkins Point augmented its supply of raw-material with ilmenite concentrate from its newly opened Lakehurst, New Jersey, mine.

REVIEW BY COUNTIES

Allegany.—Coal production decreased 10 percent primarily because of decreased output of strip mining. There were four strip mines less in operation than in 1961. A slight increase in production was reported from 16 active underground mines (14 operated in 1961). Most production was from the Franklin and Bakerstown seams. Total output of sand and gravel increased 10 percent, and total value 8 percent. Cumberland Cement & Supply Co. processed sand and gravel for building and paving material at its River No. 3 plant near Cumberland and processed sand for building and industrial uses at its Quartzite Plant No. 1 also near Cumberland. Fry Coal and Stone Co., Division of Martin Marietta Corp., produced crushed limestone from the Martin Mountain quarry near Flintstone. The Sensabaugh and the Cumberland Rock Cut quarries near Cumberland mined limestone for concrete aggregate and roadstone. Kaiser Refractories and Chemicals Division, Kaiser Aluminum & Chemicals Corp., produced fire clay from one open-pit and one underground mine near Frostburg for manufacturing firebrick.

TABLE 3.—Value of mineral production in Maryland, by counties [1]

County	1961	1962	Minerals produced in 1962 in order of value
Allegany	[2] $2,051,312	$1,897,179	Coal, sand and gravel, stone, clays.
Anne Arundel	1,987,367	2,127,469	Sand and gravel.
Baltimore	12,635,102	14,113,015	Stone, sand and gravel, clays.
Calvert	(3)	(3)	Greensand marl, diatomite.
Caroline	(3)	(3)	Sand and gravel.
Carroll	(3)	(3)	Cement, stone, clays, soapstone.
Cecil	1,802,114	2,920,620	Stone, sand and gravel, clays, gem stones.
Charles	(3)		
Dorchester	(3)	(3)	Sand and gravel, stone.
Frederick	[2] 8,108,794	8,039,934	Cement, stone, lime, gem stones.
Garrett	[2] 3,283,787	3,504,160	Coal, natural gas, stone, sand and gravel.
Harford	1,058,198	1,340,296	Sand and gravel, stone, talc.
Howard	(3)	(3)	Stone.
Kent	75,200	32,303	Clays, peat, sand and gravel.
Montgomery	(3)	(3)	Stone.
Prince Georges	10,494,513	9,164,079	Sand and gravel, clays.
Queen Annes	40,000		
St. Marys	(3)	(3)	Sand and gravel.
Talbot	(3)	(3)	Do.
Washington	(3)	(3)	Cement, stone, clays, potassium salts, sand and gravel.
Wicomico	102,711	103,113	Sand and gravel, clays.
Worcester	28,616	41,421	Do.
Undistributed [4]	[2] 21,189,864	23,345,834	
Total	[2] 62,858,000	66,629,000	

[1] Somerset County is not listed because no production was reported.
[2] Revised figure.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Includes values indicated by footnote 3 and some gem stones and sand and gravel (1961) not assigned to specific counties.

Anne Arundel.—The county dropped from second to third place in the State in production and value of sand and gravel. Tonnage decreased 6 percent, and value 7 percent. Sand and gravel was produced at 11 operations near Baltimore, Davidsonville, Hanover, Linthicum Heights, and Pasadena. Output was chiefly prepared sand and gravel for building and paving. Severn Clay Co., Glen Burnie, discontinued their clay operation.

Baltimore and Baltimore City.—The county continued to rank first in value of production among the 20 mineral producing counties in the State. Value of mineral output increased 12 percent. Stone led in the value of minerals produced, followed by sand and gravel. Basalt was quarried and crushed primarily for concrete aggregate, roadstone, and railroad ballast at plants near Hyde and White Hall. Crushed limestone for concrete roadstone was produced by The Arundel Corp. at the Greenspring quarry near Baltimore. Harry F. Campbell Sons' Corp., subsidiary of The Flinkote Co., produced crushed limestone at the Marriottsville and Texas quarries for many uses including concrete aggregate and roadstone. Crushed oystershell for poultry grit and lime was produced at the Oyster Shell Corp. mill near Baltimore. Miscellaneous stone (serpentine) was quarried near Reisterstown and was crushed for road material. Dimension quartzite for construction (rough), both architectural (dressed) and flagging, was quarried by the C. E. Weaver Stone Co. near Butler.

Baltimore County advanced from third to second place in production of sand and gravel. The output, mainly used for building and paving, increased 25 percent and came from five plants operated near Baltimore, Overlea, and White Marsh. Tonnage of clay produced was 6 percent more than in 1961. Miscellaneous clay was produced by three companies from four pits. Output was used for manufacturing building brick. Ball clay mined at a pit near Baltimore was used in making stoneware, pottery, floor and wall tile, and firebrick and block.

National Gypsum Co., calcined imported gypsum at its plant in Baltimore. The United States Gypsum Co. opened a new gypsum plant in Baltimore. This plant, covering an area of 250,000 square feet on a 35-acre site, was the company's first plant in the Baltimore area but its seventh plant on the Eastern Seaboard.

A plant in Baltimore expanded crude perlite (obtained from New Mexico) for use in building plaster, and as concrete aggregate, and filter aid.

Calvert.—Kaylorite Co. (Dunkirk), the only greensand marl producer in the State, sold its output for use as a soil conditioner. For the first time the company reported that a small tonnage of diatomite was sold for experimental use from extensive reserves of diatomaceous earth on its property.

Caroline.—Sand and gravel was produced near Greensboro by Cook and Son. Most of the processed material was used for building and paving construction.

Carroll.—The county continued to lead in cement output and was second in the State in value of mineral production. Lehigh Portland Cement Co. at Union Bridge mined and crushed limestone, sandstone, and shale for cement manufacture. The company also produced general-use and moderate-heat as well as high-early-strength portland cements and masonry cement by the dry process at its 3-kiln plant. Most of the shipments were in bulk to ready-mixed concrete companies. The company's Union Bridge quarry was cited in the National Safety Competition for its outstanding 1962 safety record of 44,605 man-hours worked without a disabling work injury. Limestone was quarried and crushed for concrete aggregate and road base

material by Teeter Stone, Inc., a subsidiary of Harry T. Campbell Sons' Corp. The company's quarry also received a citation in the National Safety Competition for an outstanding 1962 safety record of 50,649 man-hours worked without a disabling work injury. Liberty Stone Co. mined and crushed soapstone at its plant near Marriottsville. Most of the material was transferred to the company's Sykesville plant for further processing. The processed soapstone was marketed chiefly for use as an asphalt filler and for roofing. Other uses included foundry facings, rubber filler, and as a refractory.

Cecil.—Basalt was mined at the Elk Mills quarry by D. M. Stoltzfus & Son, Inc., and crushed for riprap, concrete aggregate, and roadstone. Dimension granite was quarried by Port Deposit Quarries Co., Inc., near Port Deposit for rubble and dressed construction stone. Granite was quarried for riprap and for crushing to concrete aggregate and roadstone near North East by Maryland Materials Co., Inc. Harbison-Walker Refractories Co. manufactured silica brick from quartzite quarried and crushed at its Leslie operation. Sand and gravel production was 40 percent more than that of 1961. Output from pits near Elkton, North East, Perrysville, Port Deposit, and Rising Sun was used mainly for building and paving. Fire clay, including plastic and some white clay, was produced at two pits near North East. A small quantity of williamsite-gem-specimen material was collected.

Dorchester.—Processed sand and gravel for building construction and bank-run sand for fill were produced at a stationary plant near Federalsburg by J. Edwin Rosser, Inc. Crushed oystershell for poultry grit and lime was produced by J. M. Clayton Co., Cambridge.

Frederick.—Portland and masonry cements were manufactured at Lime Kiln by Alpha Portland Cement Co. Types I, II, and III air-entrained and non-air-entrained portland cements and some masonry cement were produced by the wet process. Company-produced cement rock and sandstone were fed to two 400-foot by 11-foot, 4½-inch rotary kilns. The largest consumers of cement were the ready-mixed concrete companies. Over half (58 percent) of the output was consumed in the State, the balance was shipped to the District of Columbia, Pennsylvania, Virginia, and West Virginia. Limestone and cement rock were quarried and crushed near Frederick, Le Gore, Lime Kiln, New London, and Woodsboro chiefly for concrete aggregate and roadstone and for cement and lime manufacture. Quicklime and hydrated lime were produced near Le Gore, Middletown, and Woodsboro, for agricultural use. The quarry groups of the M. J. Grove Lime Co.'s Grove quarry an Alpha Portland Cement Co.'s Lime Kiln quarry received citations in the National Safety Competition for outstanding safety record achieved in 1962 for 228,677 man-hours and 40,024 man-hours, respectively, worked without a disabling work injury. Management of the Lehigh Portland Cement Co. announced the purchase of a tract of land near Woodsboro, not far from its Union Bridge plant that contains extensive deposits of material suitable for lightweight aggregate. Preliminary plans were completed for the construction of a processing plant with an initial annual capacity of 350,000 tons of lightweight aggregate.

Garrett.—The county production of bituminous coal increased 14 percent. Yield from 16 strip mines, the same number that were active in 1961, rose 5 percent. Output from 19 underground mines, 4 mines less than were active in 1961, increased 29 percent. Added tonnage from the Laurel No. 1 Mine of the Buffalo Coal Co. working in the Freeport seam and the Mary Beth Mine of the E. & P. Coal Co. mining in the Kittanning seam, the largest single mine producers in Garrett County, were chiefly responsible for the rise in underground production. Limestone was mined and crushed for concrete aggregate and roadstone at the Fry and Browning quarries, 9 miles north of Oakland. Limestone was recovered by underground mining at the Browning quarry. Sand for building, paving, and use on roads was obtained from two pits near Oakland.

Harford.—Sand and gravel was produced at five operations near Aberdeen, Abingdon, Edgewood, and Harford for building and paving. Crushed basalt (traprock) was produced by D. M. Stoltzfus & Son, Inc., at its Grays Run plant near Aberdeen and the Gatch Crushed Stone Co. quarry near Churchville. Crushed limestone production was reported for the first time by The Howard-Montgomery Crushed Stone Co. from its quarry near Clarksville. The Maryland Green Marble Co. dressed, sawed, and cut marble for building interiors and crushed marble for terrazzo. Harford Talc & Quartz Co., Inc., mined and processed talc near Dublin for use in a wide variety of industrial applications.

Howard.—Crushed basalt (traprock) for concrete aggregate and roadstone was produced at the Savage quarry of the Arundel Corp.

Kent.—Miscellaneous clay for building brick was mined from an open pit near Chestertown by Chestertown Brick Co. Some reed-sedge peat for agricultural purposes was produced by Maryland Peat Humus Co. A small quantity of sand and gravel chiefly for building use was produced by Kent Sand & Gravel Co.

Montgomery.—Crushed basalt (traprock) was mined by Rockville Crushed Stone Co., Rockville, for concrete aggregate and roadstone. Mica schist was quarried for rough dimension building stone, flagging, and rubble by Stoneyhurst Quarries near Bethesda.

Prince Georges.—Although production of sand and gravel decreased 10 percent in tonnage and 13 percent in value, the county continued to lead in sand and gravel production. The structural and paving market consumed most of the county output. Sixty-nine percent of the sand and gravel output was prepared by washing or screening. Production was reported from 19 operations, mostly near Beltsville, Bowie, Upper Marlboro, and Washington, D.C. Washington Brick Co., Muirkirk (now a Division of Thos. Somerville Co.), and West Brothers Brick Co., all near Washington, D.C., produced miscellaneous clay chiefly for manufacturing building brick. William L. Allen produced fire clay from a pit near Laurel for use in foundries and steel plants. Iron oxide pigments in a variety of colors were manufactured by Mineral Pigments Corp. at Muirkirk. A plant near Washington, D.C., expanded crude perlite (obtained from Colorado and Idaho) for use principally in building plaster and concrete aggregate. Crude vermiculite from Montana and South Carolina was exfoliated at a plant near Beaver Heights.

St. Marys.—Dean and Beavers plant was purchased by Charlotte Hill Sand & Gravel Corp. Leonardtown Sand & Gravel Co. operated a plant near Leonardtown. Both plants processed sand and gravel for building, paving, and other uses.

Talbot.—A quantity of gravel was produced for State road work.

Washington.—Although the value of mineral production remained about the same as in 1961, the county dropped to fourth place in the State in value of minerals produced. Marquette Cement Co. quarried and crushed limestone primarily for manufacturing cement at its Security plant. General-use and moderate-heat as well as high-early-strength portland cements and masonry cement were produced by the dry process. Most of the material was consumed in the State, but large shipments were made to the District of Columbia, Pennsylvania, and Virginia. The company also produced potassium sulfate as a by-product of cement clinkers. The company's Security quarry group near Hagerstown received recognition in the National Safety Competition for an outstanding 1962 safety record of 113,002 man-hours worked without a disabling work injury. Crushed limestone, mostly for concrete aggregate and roadstone, was produced by Fry Coal & Stone Co., Division of Martin Marietta Corp. at its Boonsboro, Hancock, Hagerstown, and Pinesburg plants. Miscellaneous clay for building brick, cement, and fertilizer filler was recovered from an open pit near Williamsport by Victor Cushwa & Sons, Inc.

Wicomico.—Salisbury Brick Co., Inc., mined miscellaneous clay obtained from an open pit near Salisbury for building brick. Sand and gravel, produced at five operations near Hebron, Fruitland, Salisbury, and Tyackin, was chiefly for building and paving.

Worcester.—The Worcester County Highway Department crews produced bank-run sand and gravel for use on State road work.

The Mineral Industry of Massachusetts

By Robert W. Metcalf [1] and Victoria M. Dorchak [2]

MASSACHUSETTS mineral production declined 2 percent in value in 1962 but was still the second highest annual value on record. The value of sand and gravel production increased slightly but that of stone showed a moderate decrease. Large quantities of stone and sand and gravel were used in the very active road-building program in the State. Production of clays for building brick and lightweight aggregate, the latter a new industry in Massachusetts, increased by more than one-fifth. Production of lime also was higher. Output of peat decreased.

As the result of a large output of crushed and dimension stone and sand and gravel, Middlesex County retained its lead as the chief producing county in quantity and value. The second and third producing counties in terms of value were Berkshire and Norfolk, respectively.

TABLE 1.—Mineral production in Massachusetts [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays.....short tons	104,084	$85	125,470	$96
Gem stones	(2)	2	(2)	2
Lime.....short tons	144,831	2,307	148,401	2,337
Sand and gravel.....do	18,060,656	14,958	17,565,834	15,026
Stone.....do	5,210,140	13,399	4,984,662	12,541
Value of items that cannot be disclosed: Mineral fuels and nonmetals		38		33
Total		[3] 30,789		30,035

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Revised figure.

[1] Mineral specialist, Bureau of Mines, Pittsburgh, Pa.
[2] Statistical clerk, Bureau of Mines, Pittsburgh, Pa.

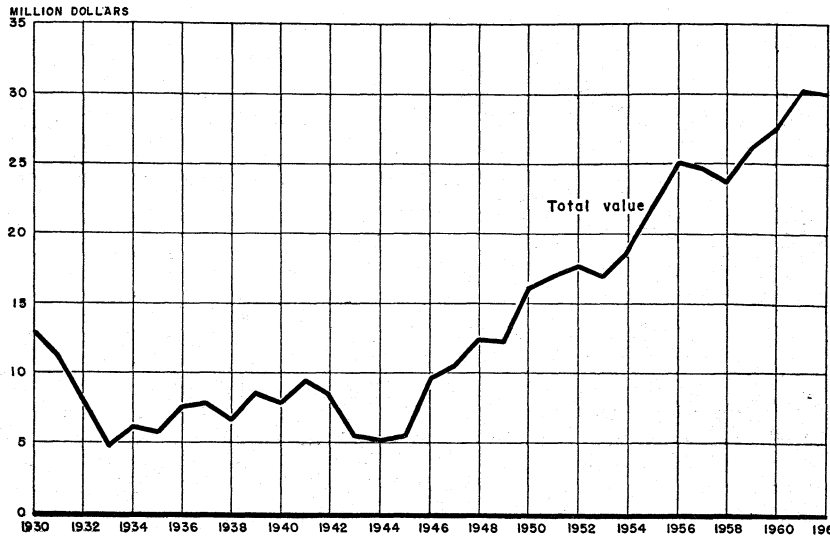

FIGURE 1.—Total value of mineral production in Massachusetts, 1930–62.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Argon.—Air Reduction Co. Inc., South Acton, Middlesex County, produced argon in connection with the manufacture of nitrogen.

Clays.—Output of clays increased sharply, largely because of the beginning of operations at a $2 million plant built by Masslite, Inc., Plainville, Bristol County. This firm used shale in the production of lightweight aggregates, a new industry in Massachusetts. This lightweight material was consumed in the manufacture of building blocks and concrete by firms in Eastern New England. Four other companies mined miscellaneous clay in the State for manufacturing building brick.

Gem Stones.—Emery, epidote, and other specimen minerals were collected in Hampden County. Other gem materials were collected, chiefly by hobbyists, from various other locations in the State.

Gypsum.—Imported crude gypsum from Nova Scotia was manufactured into calcined gypsum products at Charlestown, Suffolk County.

Lime.—Three producers in Berkshire County produced quicklime and hydrated lime from local limestone. Output increased 2 percent and was only 3 percent below the peak year of 1960. Output was 75 percent of rated capacity. The chemical industry consumed nearly 70 percent of the production, and a sizable tonnage was used by the building industries. Smaller amounts were for agriculture. The paper, whiting, tannery, and paint industries were the chief consumers of chemical and industrial lime. Most lime was shipped into the New York-New England region. New England Lime Co., purchased in 1961 by Chas. Pfizer & Co., Inc., New York, was operated as a division of that company.

TABLE 2.—Lime sold by producers

Year	Short tons	Value	Year	Short tons	Value
1953–57 (average)	133,941	$2,029,764	1960	153,710	$2,370,059
1958	139,062	2,120,677	1961	144,831	2,306,710
1959	143,567	2,289,250	1962	148,401	2,337,027

Nitrogen Compounds.—Air Reduction Co., Inc., produced nitrogen at its plant at South Acton, Middlesex County.

Oxygen.—Air Reduction Co., Inc., produced oxygen at its nitrogen plant at South Acton, Middlesex County.

Peat.—Output of peat remained at a high level. Two producers recovered humus and reed-sedge peat in Essex and Worcester Counties.

Perlite.—A Roslindale, Suffolk County plant expanded crude perlite from Colorado and marketed the expanded material for use as a lightweight aggregate in concrete and building plaster. Some was sold as a soil conditioner. Production was lower than in 1961.

Sand and Gravel.—Production of sand and gravel declined 3 percent from the record 18 million tons in 1961, owing chiefly to decreased output of sand and gravel for paving and sharply declined output of paving gravel for Government-and-contractor operations. Value of production, however, rose slightly because of an increase in average value per ton of $0.03 to $0.86. The value of sand and gravel production in 1962 mounted to 50 percent of the mineral production value of the State. Noteworthy was the doubled output of commercial sand used for fill. Government-and-contractor sand and gravel used for fill decreased slightly but, combined with commercial output, was 30 percent of the total sand and gravel production. This reflected greatly increased activity in the initial stages of new road-building. Seventy-one percent of the commercial output was used in building and paving. Smaller tonnages of molding and foundry sand plus sand for ice control also were sold. About 77 percent of the commercial output was sold as washed, screened, or prepared material, and virtually all the Government-and-contractor output was sold as bank-run material.

Active commercial pits totaled 163 compared with 176 in 1961. Production of sand and gravel in Middlesex County was 3.4 million short tons and supplied a large part of the Boston Metropolitan area. Four other counties produced over 1 million tons each, Worcester, Norfolk, Hampden, and Bristol counties.

Government-and-contractor production decreased 21 percent, and only 92 pits were active compared with 124 in 1961. All counties except Suffolk reported Government-and-contractor output. The largest county producing Government-and-contractor tonnage was Hampshire County, with 1.875 million tons, followed in descending order by Franklin, Middlesex, and Bristol Counties.

TABLE 3.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1961		1962	
	Short tons	Value	Short tons	Value
Commercial operations:				
Sand:				
Glass			109	$300
Structural	2,902,295	$2,850,051	2,910,098	2,952,482
Paving	1,820,941	1,805,699	1,561,304	1,517,043
Fill	706,570	225,099	1,430,552	543,382
Undistributed [1]	410,864	658,104	522,768	873,150
Total	5,840,670	5,538,953	6,424,831	5,886,357
Gravel:				
Structural	2,973,410	3,941,914	3,146,537	4,326,601
Paving	2,133,955	2,209,048	1,823,644	1,929,862
Fill	918,817	503,792	991,097	545,234
Other	452,111	230,438	405,653	275,320
Undistributed [2]	295,206	178,394	481,874	338,301
Total	6,773,499	7,063,586	6,848,805	7,415,318
Total sand and gravel	12,614,169	12,602,539	13,273,636	13,301,675
Government-and-contractor operations:				
Sand:				
Structural	515	515	100	100
Paving	152,687	93,748	125,500	54,160
Fill	2,563,187	952,381	2,430,000	895,500
Other	17,800	12,541	43,758	23,331
Total	2,734,189	1,059,185	2,599,358	973,091
Gravel:				
Paving	2,302,795	1,152,982	1,282,340	605,720
Fill	409,503	143,326	410,000	145,000
Other			500	500
Total	2,712,298	1,296,308	1,692,840	751,220
Total sand and gravel	5,446,487	2,355,493	4,292,198	1,724,311
All operations:				
Sand	8,574,859	6,598,138	9,024,189	6,859,448
Gravel	9,485,797	8,359,894	8,541,645	8,166,538
Total	18,060,656	14,958,032	17,565,834	15,025,986

[1] Includes blast sand, molding sand, ground sand, and sand for other uses.
[2] Includes railroad ballast and miscellaneous gravel.

Stone.—Output of stone decreased 4 percent in quantity and 6 percent in value chiefly because of a 6 percent reduction in output of dimension granite and a 7 percent decline in the production and sales of basalt. There was a sharp reduction in production of dressed architectural granite and granite curbing and flagging. In addition, there was a $1.00 per ton decrease in the value of dimension granite. The most important stone produced in terms of tonnage and value was basalt, which was largely consumed for concrete aggregate and road-base material. Production of miscellaneous stone and dimension sandstone decreased, and output of crushed granite was 7 percent higher than in 1961. Production of limestone produced in Berkshire County increased in quantity and value.

Output of stone came from 11 counties (except Barnstable, Dukes, and Nantucket). In terms of tonnage, the leading stone-producing county was Middlesex, followed in decreasing order by Essex, Norfolk, Hampden, and Berkshire Counties. Measured by value, Mid-

dlesex County still led, followed by Norfolk, Essex, Berkshire, and Hampden.

Roofing Granules.—A firm at Norwood, Norfolk County, manufactured natural and artifically colored roofing granules from miscellaneous stone. Sales were uncolored material for asphalt roofing and as a base for colored roofing granules. Artificially colored granules comprised most of the output, which was smaller than in 1961.

TABLE 4.—Stone sold or used by producers, by uses

Use	1961		1962	
	Short tons	Value	Short tons	Value
Riprap	96,073	$141,732	44,006	$66,885
Concrete aggregate and roadstone	3,859,202	6,144,156	3,688,769	5,931,278
Railroad ballast	252,266	386,922	(1)	(1)
Agricultural (limestone)	163,703	512,808	175,438	546,275
Undistributed [2]	838,896	6,213,157	1,076,449	5,996,425
Total	5,210,140	13,398,775	4,984,662	12,540,863

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes dimension stone, furnace flux, railroad ballast (1962), and other uses.

Vermiculite.—Plants in Middlesex and Norfolk Counties exfoliated South African and domestic vermiculite for sale mainly as lightweight aggregate material and for insulation.

METALS

As evidence of the increased activity in metal working and the growing demand for shaped exotic materials in Massachusetts, two new large extrusion presses had been built and installed. One was an 1,800-ton press for the extrusion of larger and more versatile aluminum shapes for the Northeast Aluminum Co. at Lawrence; the other a 1,440-ton machine for the Nuclear Metals, Inc., West Concord plant. The latter was to be used for drawing aerospace structural parts and die materials and would allow the working of many metals ranging from aluminum to zirconium.[3]

Of importance to the manufacture of super-refractory materials were the carbides of zirconium, hafnium, columbium, and tantalum produced by a New England firm by a combination of chemical and heat techniques. These carbides were pyrolytically deposited. Their high-temperature and chemical-corrosion resistance were expected to be applicable to chemical, paper, and petroleum process operations. Melting points are 6,300° F for columbium and zirconium carbides and 7,000° F for tantalum and hafnium carbides.[4]

[3] American Metal Market. Northeast to Triple Capacity with New Press and Equipment. V. 69, No. 67, Apr. 6, 1962, p. 10.
American Metal Market. Baldwin-Lima Builds 1,400-Ton Press To Extrude "Exotic Shapes". V. 69, No. 222, Nov. 20, 1962, p. 15.
[4] American Metal Market. Graphite Backed Tantalum Carbide Said to Withstand 5,000° F. V. 69, No. 198, Oct. 12, 1962, p. 17.

REVIEW BY COUNTIES

Basalt was quarried and crushed by the Commonwealth of Massachusetts, Department of Public Works, for its own use, for concrete aggregate, roadstone, fill, and riprap at locations in Bristol, Hampden, Norfolk, and Plymouth Counties. It also produced sand and gravel chiefly for paving either by its own crews or under contract in all counties except Suffolk.

Barnstable.—Concrete Products Co. of Cape Cod, Inc., produced sand and gravel for building near Falmouth. Frederick V. Lawrence, Inc., sold prepared sand and gravel for building and paving and bank-run gravel for fill. Molding sand was produced by Whitehead Brothers Co. Five small producers also produced paving sand and gravel. The Turner & Breivogel, Inc., property, which formerly yielded granite at Falmouth Heights, was sold and was being converted into a golf course and country club.

TABLE 5.—Value of mineral production in Massachusetts, by counties

County	1961	1962	Minerals produced in 1962 in order of value
Barnstable	$244,538	$198,201	Sand and gravel.
Berkshire	[1] 5,153,705	5,110,131	Lime, stone, sand and gravel.
Bristol	2,351,423	2,090,562	Sand and gravel, stone, clays.
Dukes	37,715	31,494	Sand and gravel.
Essex	2,409,958	2,416,764	Stone, sand and gravel, peat.
Franklin	691,815	722,898	Sand and gravel, stone.
Hampden	2,383,031	2,431,078	Stone, sand and gravel, clays.
Hampshire	1,080,278	1,036,189	Sand and gravel, stone.
Middlesex	9,475,049	8,908,876	Stone, sand and gravel.
Nantucket	7,579	6,580	Sand and gravel.
Norfolk	3,361,722	3,831,744	Sand and gravel, stone, clays.
Plymouth	923,420	714,547	Sand and gravel, clays, stone.
Suffolk	304,429	437,177	Stone, sand and gravel.
Worcester	2,362,117	2,095,916	Sand and gravel, stone, peat.
Undistributed [2]	2,000	3,000	
Total	[1] 30,789,000	30,035,000	

[1] Revised figure.
[2] Includes gem stones unspecified by counties.

Berkshire.—Lime and limestone were produced only in Berkshire County. Output of lime increased 2 percent. Producers included New England Lime Co., Adams; United States Gypsum Co., Farnams; and Lee Lime Corp., Lee. Most of the lime was used for construction purposes and for chemical and industrial uses plus a small tonnage for agricultural lime. Limestone was produced by these three firms and by John S. Lane & Son, West Stockbridge. The principal uses were agstone, lime manufacture, as a filler in rubber and asphalt, and as mineral food. Small tonnages also were sold for blast furnace flux and for miscellaneous uses. Rough monumental dimension granite was quarried and sold by Otis Chester Granite Co., Otis.

Production of commercial sand and gravel increased 14 percent. Over 40 percent of the sand was consumed in building purposes, and a significant quantity was used for ice control. About one-third of the gravel was used for paving, and sizable quantities were used as fill. Prepared sand and gravel comprised 78 percent of the total. The leading producer was General Sand & Stone Corp., near Dal-

ton. Other large producers included W. E. Williams, Inc., Lenox Dale; Berkshire Gravel, Inc., Pittsfield; Nat Beacco, Stockbridge; and Maxymillian, Inc., Adams.

Bristol.—Output of commercial sand and gravel decreased 8 percent. Washed or screened material comprised 77 percent of the total. The principal use was in building; most of the remainder was sold for paving and fill. The largest producers included Assonet Sand & Gravel Co., Inc., Freetown; Morse Sand & Gravel Co., Dartmouth; River Sand & Gravel Co., Inc., Pawtucket, R.I.; Joseph Borge & Sons, Inc., Swansea; and George L. Greenwood & Son, Westport. Warren Bros. Road Co., Acushnet, quarried basalt for concrete aggregate and roadstone. The Morse Sand & Gravel Co. basalt quarry near Attleboro was idle during 1962. Stiles & Hart Brick Co. mined miscellaneous clay at Taunton for manufacturing building brick.

Dukes.—Chiefly because of increased road construction, sand and gravel production rose substantially. Sand and gravel also was used in building and a sizable tonnage for fill. Producers were Goodale Construction Co., Vineyard Haven, and Grant Bros., Inc., Edgartown. No output was reported by Colby Construction Co.

Essex.—Crushed basalt was produced by Lynn Sand & Stone Co., Swampscott; Essex Bituminous Concrete Corp., West Peabody; and Trimount Bituminous Products Co., Saugus. The principal use was for concrete aggregate and smaller quantities were sold for riprap, mineral filler, and other purposes. Karl A. Persson operated a dimension granite quarry at Rockport. (It had been idle in 1961.) Products marketed consisted chiefly of rubble and flagging. Rockport Quarries Co., Inc., produced rough and dressed architectural dimension granite in a leased area in Persson's quarry.

Continued building and road construction resulted in a small increase in sand and gravel output. Nearly two-thirds of the total production was washed, screened, or otherwise prepared. Twelve operators were active. The largest were Andover Sand & Gravel, Inc., mining bank run gravel at a portable plant near Lawrence, and Yemma Brothers, Inc., which produced sand and gravel at a stationary plant at Groveland for building. Other large producers included Videtta Corp., West Peabody, which produced sand and gravel for building and gravel for fill, and Essex Sand & Gravel Co., Inc., Andover, which produced sand for use in bituminous concrete mixes. Two new producers became active during the year—Albert F. Lattof, Rockport, and Rocco Zambino & Sons, Inc., Methuen.

Peat humus was recovered by Andover Sand & Gravel, Inc., from a bog near Lawrence for sale both packaged and in bulk.

Franklin.—Commercial production of sand and gravel decreased slightly. Over one-half (56 percent) of the total output was sold as bank run or unprepared material. Warner, Inc., produced sand and gravel for paving and railroad ballast at its Zmetra pit. Macksin Sand & Concrete Products Co. produced bank run gravel and washed and screened sand for building, paving, and fill from a pit near Greenfield. Northfield Washed Sand & Gravel Co., Inc., mined and processed sand and gravel for building and paving at a

stationary plant near Northfield. Four small operators produced sand and gravel chiefly for paving, ice control, and dressing to cover oil base on township roads.

Greenfield Mass. Broken Stone Co. quarried basalt for concrete aggregate and roadstone, riprap, and railroad ballast.

Hampden.—Crushed basalt for concrete aggregate, road base, and railroad ballast was produced by John S. Lane & Sons, at its Westfield quarry. The firm's West Springfield quarry was idle. Dimension sandstone was quarried for architectural stone by McCormick Longmeadow Stone Co., Inc., at East Longmeadow.

Production of sand and gravel increased sharply because of a larger output of fill, produced mostly by John's Trucking Co., Agawam. This indicated the start of expanding road construction activity. Other large producers were North Wilbraham Sand & Gravel & Concrete Co., Inc., North Wilbraham, and Monson Sand & Gravel Corp., Monson. These two firms produced sand and gravel for building and paving as well as sand for ice control. Other firms producing sizable tonnages were Berkshire Asphalt Co., Inc., Springfield, and William Moore, Inc., Westfield, which produced sand and gravel for paving and fill.

Westfield Clay Products Co., Westfield, and Hampshire Brick Co., Willimansett, a suburb of Chicopee, mined miscellaneous clay for building brick manufacture.

Hampshire.—Output of commercial sand and gravel decreased slightly. Most of the material sold was washed or otherwise prepared. Sand comprised 46 percent of the total sales. Bill Willard, Inc., the largest producer, produced building and paving sand and gravel. Other large producers were Donovan Brothers, Inc., Huntington, and D. D. Ruxton Co., Inc., North Wilbraham. Six smaller producers mined sand and gravel for paving. Basalt was quarried at Amherst for concrete aggregate and roadstone by John S. Lane & Sons, Inc.

Middlesex.—The county again ranked first in value and production of both stone and sand and gravel. Five producers quarried dimension granite in the Westford-Chelmsford area. Producers were H. E. Fletcher Co., West Chelmsford; Guilmette Bros. Corp., and Le Masurier Granite Quarry, Inc.—both near North Chelmsford, and Oak Hill Granite Co., Inc., and Morris Bros. Granite Co., Inc., both near Westford. The product was sold for building and monumental stone, rubble, paving blocks, and curbing. Le Masurier Granite Quarry, Inc., and H. E. Fletcher Co. also sold crushed granite. Output of basalt in the county decreased 14 percent because of slackening of construction activity. Producers were Massachusetts Broken Stone Co., Weston; B. & M. Crushed Stone Co., Ashland; J. B. Condon Corp., Dracut; and Rowe Contracting Corp., Malden. Output was used mainly for concrete aggregate and roadstone plus smaller quantities for riprap.

Output of commercial sand and gravel increased moderately, and Middlesex County again accounted for over 25 percent of the production in the State. About one-half of the material produced was sand. Screened or otherwise prepared material totaled 88 percent of the total county output. Acme Sand & Gravel Co., Inc., Burling-

ton, again was the largest producer. San-Vel Contracting Co., Littleton, mined sand and gravel for building and paving. Pomerleau Brothers produced prepared sand and gravel for building and paving from a stationary plant near Westford. J. J. Cronin Co. produced prepared sand and gravel for paving at a stationary plant near Wilmington. Other important sand and gravel producers included New England Sand & Gravel Co., Framingham, Thomas Quinn Co., Inc., Burlington, Stow Sand & Gravel, Inc., Boxborough, Ashland Sand & Gravel, Inc., Ashland, and Assabet Sand & Gravel, Inc., Assabet.

The Zonolite Co., North Billerica exfoliated vermiculite for sale as lightweight aggregate and insulation.

Atlantic Cement Co., Inc., Ravena, N.Y., announced the first delivery by barge to its recently-completed cement distribution plant in the Boston area in November.[5] Marquette Cement Manufacturing Co. also reported plans for the construction of a $2 million cement-distributing plant in Boston Harbor at Everett, on a 5-acre property leased from Eastern Gas & Fuel Associates.[6]

Nantucket.—Unprocessed sand for fill was produced by Nantucket Construction Co. at a stationary plant near Nantucket. Some screened sand also was sold for use in cement.

Norfolk.—Production of sand and gravel was maintained at a high level in 1962. Virtually all the commercial sand and gravel was washed, screened, or otherwise prepared. Sand comprised 48 percent of the total. The largest producer was West Sand & Gravel Co., Walpole, which produced sand and gravel chiefly for building. Highland Sand & Gravel Co., Inc., produced sand and gravel for building at two locations—Dedham and Walpole. Building sand and gravel also was produced by Wrentham Sand & Gravel Co., Inc., near Wrentham. Other large producers of sand and gravel were A. A. Will Sand & Gravel Corp., Canton; Varney Bros. Sand & Gravel, Inc., Bellingham; Tresca Brothers Sand & Gravel, Inc., Millis; and Boston Sand & Gravel Co., Canton. One new producer, Norfolk Sand and Gravel, Inc., Norfolk, reported production of building sand and gravel and paving gravel. A brief account of the founding, history and present operations of Tresca Brothers Sand & Gravel, Inc. was published.[7]

Simeone Stone Corp., Wrentham, and Old Colony Crushed Stone Co., Quincy, produced crushed granite primarily for concrete aggregate and roadstone. Bates Brothers Seam Face Granite Co., Weymouth, and J. S. Swingle, Inc., Quincy, quarried dimension granite for rough construction work, rough architectural work, flagging, and monumental stone. Simeone Stone Corp. also produced crushed basalt for concrete aggregate and roadstone at its Stoughton quarry. Rhyolite was quarried at Wrentham by S. M. Lorusso & Sons, Inc. for use in manufacturing roofing granules.

[5] New England Construction. Atlantic Cement Now in Production. V. 27, No. 13, Nov. 19, 1962, p. 108; Pit and Quarry. V. 55, No. 6, December 1962, p. 25.
[6] New England Construction. Marquette Announces '63 Plans. V. 27, No. 13, Nov. 19, 1962, p. 96; Rock Products. V. 65, No. 12, December 1962, p. 98.
[7] New England Construction. 42 Years of Sand and Gravel. V. 27, No. 16, Jan. 7, 1962, p. 43.

Masslite, Inc., Plainville, a manufacturer of lightweight aggregate, started operations at the beginning of 1962. The plant, erected at a cost of over $2 million, used shale mined under contract from a nearby location. The company planned to market its product in the Boston-Providence-Hartford region. Present capacity of the plant was reportedly 1,000 tons per day. As parts of the shale deposit contain some intermixed sandstone, selective mining was employed, and blending operations were used to prepare material for the sintering machine. A detailed description of this plant, including mining operations, was published.[8]

Vermiculite was exfoliated by California Products Corp., Vermiculite Division, at Hingham, chiefly for lightweight aggregate in concrete and plaster and for insulation. Output was lower than in 1961.

Plymouth.—Sand and gravel production decreased 28 percent. Seventy percent of the total was sand. Most of the sand and gravel produced was washed, screened, or otherwise prepared. Marshfield Sand & Gravel, Inc., Marshfield, produced building sand and other gravel for use in concrete and road construction. Boston Sand & Gravel Co., Scituate, and Petrino Co., Whitman, produced sand and gravel for building and paving. Molding sand was produced by Whitehead Bros. Co., near Marion and Onset. Production of sand and gravel was also reported by 14 smaller operators.

In addition to its plant in Bristol County, Stiles & Hart Brick Co., South Bridgewater, operated a brick-making plant at South Bridgewater. All the company's clay output was consumed in manufacturing building brick. A description of a new beehive kiln installed during 1962 was published. The new kiln reportedly resulted in savings in fuel and labor and reduced the percentage of low quality, unsaleable brick.[9]

The Hingham Granite Quarry, formerly owned by Southeastern Stone Co., Inc., and sold to Old Colony Crushed Stone Co. in 1961, did not operate during 1962. The quarry equipment was dismantled.

Suffolk.—West Roxbury Crushed Stone Co. produced crushed basalt for concrete aggregate and roadstone from a quarry near West Roxbury.

Bank run gravel, used principally for fill, was produced by D. B. Raymond from a stationary plant near Burlington. Sand and gravel for paving was reported by five other smaller producers.

Calcined gypsum products were manufactured by United States Gypsum Co., Charleston and sold, chiefly in New England States. Raw material was imported from Nova Scotia.

Perlite was expanded at Roslindale by Whittemore Products, Inc. (formerly Whittemore Co., Permalite Division), and sold as soil conditioner and as a lightweight aggregate in concrete and plaster.

Worcester.—Commercial production of sand and gravel increased slightly. Four producers mined over 200,000 tons each. Worcester

[8] Bergstrom, John H. Lightweight Launched in New England. Rock Products. V. 65, No. 10, October 1962, pp. 54–58.

[9] Brick & Clay Record. How New Concept in Kilns Saves $35,000. V. 141, No. 1, July 1962, pp. 46–48.

Sand & Gravel Co., the largest producer, produced sand for building and highway use and gravel for fill from a stationary plant at Shrewsbury. Rosenfeld Washed Sand & Stone Co., Hopedale (near Milford) produced prepared sand and gravel for building and paving. Other large producers were De Falco Concrete Corp., Millbury; B.N.T. Sand & Gravel Co., Inc., Worcester; T. J. Keating Co., Fitchburg; E. L. Dauphinais, Inc., North Grafton; and Direnzo Bros. Sand & Gravel, Inc., Worcester.

Holden Trap Rock Co., Holden, and Mario Pendolf Co., Inc., Sterling, quarried basalt for concrete aggregate and roadstone. Production decreased sharply compared with 1961. Dimension granite used as dressed architectural stone was quarried at Milford by H.E. Fletcher Co. Also, Castellucia & Sons, Inc., produced architectural blocks at its Milford Pink granite quarry.

Sterling Peat Co., Sterling Junction, continued to produce reed-sedge peat for sale packaged and in bulk.

The Mineral Industry of Michigan

This chapter has been prepared under a cooperative agreement for collecting mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Michigan Department of Conservation, Geological Survey Division, State of Michigan.

By Donald F. Klyce [1]

PRODUCTION of minerals in Michigan totaled $446.5 million, 1 percent below the record set in 1961. Chemicals, derived from natural salines, increased 12 percent in value. Increased production of copper raised the metals group about 1 percent higher than in 1961. The value of construction materials decreased 5 percent from 1961. Much of the loss was attributed to a reduced demand for road materials. Mineral fuels declined 8 percent, and most of this loss was in petroleum production. For the first time since discovery

TABLE 1.—Mineral production in Michigan [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland—thousand 376-pound barrels	21,948	$75,172	22,682	$73,267
Masonry—thousand 280-pound barrels	1,515	4,467	1,517	4,335
Clays—thousand short tons	1,817	1,975	1,751	1,917
Copper (recoverable content of ores, etc.)—short tons	70,245	42,147	74,099	45,645
Gypsum—thousand short tons	1,295	5,095	1,278	4,791
Iron ore (usable)—thousand long tons, gross weight	9,384	87,604	9,422	85,597
Lime—thousand short tons	[2] 1,190	[2] 15,665	1,153	15,371
Manganiferous ore (5 to 35 percent Mn) short tons, gross weight	17,083	[3]		
Natural gas—million cubic feet	27,697	5,844	28,987	6,174
Peat—short tons	[2] 210,376	[2] 2,009	257,533	2,277
Petroleum (crude)—thousand 42-gallon barrels	18,901	55,191	[4] 17,117	[4] 48,783
Salt—thousand short tons	3,885	31,284	4,274	33,343
Sand and gravel [5]—do	54,603	47,790	47,563	42,029
Silver—fine ounces			401,491	436
Stone—thousand short tons	28,731	30,103	28,440	29,055
Value of items that cannot be disclosed: Bromine, calcium-chloride and calcium-magnesium chloride, gem stones, iodine, magnesium compounds, natural gas-liquids, potassium salts, and values indicated by footnote [3]		[2] 46,306		53,500
Total		[2] 450,652		446,520

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Revised figure.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Preliminary figure.
[5] Includes friable sandstone.

[1] Mineral economist, Bureau of Mines, Minneapolis, Minn.

in 1957, the prolific oilfields of the Albion-Pulaski-Scipio Trend in southern Michigan registered a decline in output. Iron ore was first in value, followed by cement, petroleum, copper, sand and gravel, salt, and stone. Nonmetals (construction materials and natural saline minerals) accounted for 57 percent of the State total.

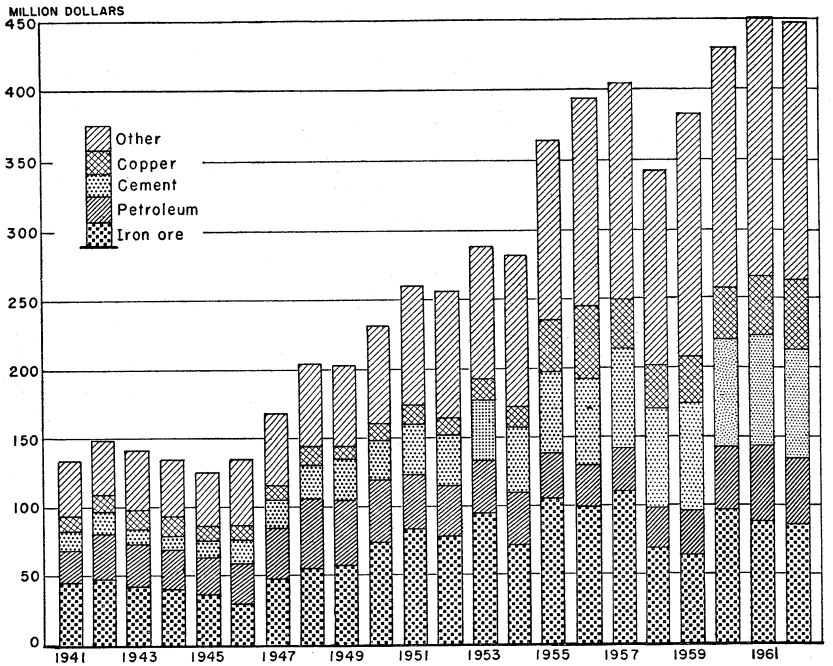

FIGURE 1.—Value of iron ore, petroleum, cement, and copper, and total value of all minerals in Michigan, 1941–62.

Employment and Injuries.—Preliminary data for the mineral industry indicated that man-hours worked in 1962 (37.7 million) declined nearly 7 percent from the 1961 figure. Office workers and employees of the entire petroleum industry are excluded from these data. Eleven fatalities were reported in 1962 (four in iron mining, three in copper mining, and one each in brine, cement, limestone, and sand and gravel operations), compared to three in 1961. The Calcite Quarry, operated by Michigan Limestone Division of United States Steel Corp., was awarded the Sentinels of Safety trophy, in the quarry group of the 1962 National Safety Competition, for the third successive year. The quarry was operated 910,881 man-hours in 1962 without a disabling work injury.

Table 2 contains a summary of employment and injury data for selected State mineral industries. Certain industries are excluded from the table, primarily to avoid disclosing individual company confidential data.

TABLE 2.—Employment and injuries for selected mineral industries [1]

Year and industry	Average number of men working	Total man-hours	Total number of disabling injuries		Total number of days lost or charged	Injury frequency rate [2]	Injury severity rate [3]
			Fatal	Nonfatal			
1961:							
Cement [4]	1,470	3,870,643		20	(5)	5.17	(5)
Clays [6]	234	515,885		12	120	23.26	233
Coke ovens	885	2,550,949		7	(5)	2.74	(5)
Copper	2,223	5,494,245	1	136	11,721	24.94	2,133
Gypsum	350	752,863		3	229	3.98	304
Iron ore	4,477	7,411,756	1	185	21,146	25.10	2,853
Limekiln [7]	175	484,000		1	(5)	2.07	(5)
Limestone [8]	1,434	2,598,357		16	(5)	6.16	(5)
Marl	72	46,608					
Sand and gravel	2,825	5,666,257	1	93	13,321	16.59	2,351
Sandstone	15	13,286					
Smelters	261	639,232		11	210	17.21	329
1962: [9]							
Cement [4]	1,403	3,666,084	1	10	6,297	3.00	1,718
Clays [6]	234	509,255		1	59	1.96	116
Coke ovens	954	2,785,015		14	(5)	5.03	(5)
Copper	1,925	4,648,447	3	113	21,835	24.95	4,697
Gypsum	305	465,838		1	243	2.15	522
Iron ore	3,784	7,084,324	4	216	33,582	31.05	4,740
Limekiln [7]	137	364,653		4	63	10.97	173
Limestone [8]	1,399	2,514,977	1	16	6,620	6.76	2,632
Marl	56	35,222					
Sand and gravel	2,723	4,842,997	1	63	9,159	13.21	1,891
Sandstone	13	14,426		1	45	69.32	3,119
Smelters	257	623,317		3	20	4.81	32

[1] Excludes officeworkers.
[2] Total number of injuries per million man-hours.
[3] Total number of days lost or charged per million man-hours.
[4] Includes cement plants and quarries or pits producing raw material used in manufacturing cement.
[5] Data not available.
[6] Excludes pits producing clay used in manufacturing cement.
[7] Includes quarries producing limestone used in manufacturing lime.
[8] Exludes quarries producing limestone used in manufacturing cement and lime.
[9] Preliminary figures.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Although shipments of cement increased 3 percent in quantity, the value of shipments dropped 2.5 percent, principally because of a 20-cent drop per barrel in the average mill value of portland cement. Production came from nine plants in seven counties. The total capacity of the plants in the State was 34 million barrels, 3 million barrels more than in 1961, as a result of the enlargement of the Huron Portland Cement Co. mill at Alpena. Yearend stocks of portland cement at mills were 3.1 million barrels, 388,000 barrels more than at the beginning of 1962. Nearly 60 percent of the cement shipped was used in the State. Out-of-State shipments went principally to Illinois, Ohio, Wisconsin, and New York. Smaller amounts were shipped to Minnesota, Indiana, West Virginia, and North Dakota. Over half of the shipments went to ready-mixed concrete companies, and the remainder went principally to highway and other contractors, concrete-product manufacturers, and building material dealers. The distribution pattern was unchanged from previous years. Masonry cement was produced at six plants and output was about the same as in 1961. The average mill value per barrel declined 9 cents to $2.86.

TABLE 3.—Finished portland cement produced, shipped, and in stock

(Thousand barrels and thousand dollars)

Year	Active plants	Production	Shipped from mills		Stocks at mills Dec. 31
			Quantity	Value	
1953–57 (average)	7	18,382	18,304	$53,530	1,616
1958	8	19,841	19,691	65,738	2,443
1959	8	21,561	21,682	72,198	2,912
1960	9	20,971	21,187	73,082	3,023
1961	9	21,661	21,948	75,172	2,737
1962	9	23,070	22,682	73,267	3,161

Raw materials used in the manufacture of cement included 5.3 million tons of limstone, 1.6 million tons of clay or shale, as well as sand, gypsum, mill scale, pyrite cinders, iron ore, slag, grinding aids, and air-entraining compounds. Nearly 515 million kilowatt-hours of electrical energy was used at the plants. The wet process was used at all plants except one that used the dry process.

Clays.—Miscellaneous clay and shale was mined in 10 counties at 16 sites. Clay for cement was produced at seven operations and accounted for nearly 85 percent of the State total. The balance of the clay mined was used for lightweight aggregate, heavy clay products (brick, draintile, and sewer pipe), and pottery. The largest production of clay was reported from Alpena, Wayne, Monroe, Saginaw, and St. Clair Counties.

Gem Stones.—Agate, native copper specimens, datolite, dolomite, domeykite, and thomsonite were collected. Most of the specimens were found in the northern peninsula, particularly in Keweenaw and Ontonagon Counties.

Gypsum.—Quarries in Iosco County and underground mines in Kent County produced gypsum. The crude material was processed at plants in Grand Rapids, Detroit, National City, and plants in other States. Lath, plaster, exterior sheathing, and plasterboard were the principal gypsum products manufactured. A decrease both in tonnage and unit price lowered the value of 1962 output by 6 percent. A new gypsum quarry was opened by Michigan Gypsum Co. in Iosco County in July.

Lime.—Production of lime decreased about 3 percent in volume and 2 percent in value from 1961. Data for regenerated lime (produced by paper mills, water purification plants, and acetylene processors) are excluded from the State total value of mineral production in 1961 and 1962. Lime was produced in nine counties, with the principal output coming from Wayne County. Over 80 percent of the lime produced was used by the producers. The principal uses for the lime were chemical, metallurgical, paper manufacture, water treatment, and sugar manufacture. A small percentage of the lime manufactured was hydrated; the balance was reported as quicklime. Annual lime-burning capacity of the reporting plants exceeded 1.8 million tons.

Natural Salines.—Bromine, calcium chloride, calcium-magnesium chloride, iodine, magnesium compounds, and potash were extracted from natural well brines at plants in Gratiot, Lapeer, Mason, Manistee, and Midland Counties. The value of output was 16 percent higher than in 1961.

Perlite.—Expanded perlite was produced at plants in National City and Grand Rapids from crude ore mined in Colorado and Nevada. Most of the material was used in building plaster and as concrete aggregate. Output was down 11 percent, whereas value of shipments declined only 5 percent, because of a higher average price of the expanded material.

Salt.—Production came from natural well brines, artificial brines, and one underground mine. Production was reported from 10 plants in 6 counties, Wayne County had the largest output. Production was 10 percent larger than in 1961, owing principally to a greater demand for salt for highway ice removal. The principal uses for salt were in chemical manufacture (chlorine, soda ash), meat packing, animal feed, water softening, and ice removal.

Sand and Gravel.—Michigan ranked second in production and third in value of sand and gravel in the Nation. Sand and gravel production was reported in all counties but Iosco County, and was the only mineral commodity produced in six counties. Although sand and gravel was produced throughout the State, output was concentrated near the large urban centers. Over 36 percent was produced in the Detroit area. Large tonnages also were reported from Berrien, Chippewa, Kent, Kalamazoo, Ottawa, and Tuscola Counties.

Output of sand and gravel declined about 13 percent from 1961. The decrease was caused by smaller demand for road materials. Sales of sand and gravel for industrial use, railroad ballast, fill, and building construction showed modest increases over 1961. Nearly 44 million tons of sand and gravel was transported by truck and the balance was moved by rail and water. Production was reported from 278 commercial operations and 131 Government-and-contractor operations.

Stone.—Basalt, marl, limestone, and sandstone were quarried. Limestone, which accounted for 99 percent of the volume, was quarried in 15 counties by 20 commercial producers and 4 county highway agencies. The greater proportion of the tonnage came from large quarries in the northern part of the State. Over 22 million tons was moved by water from company-operated ports on Lakes Huron and Michigan to industrial consumers, steel mills, and cement and lime plants. Output was 1 percent less than in 1961 because of decreased demand for roadstone and concrete aggregate.

Of the 28.2 million tons of crushed limestone produced, 10.5 million tons was used for flux, 13.2 million tons for chemicals, cement, and lime manufacture, and 3.7 million tons for highway use. The remaining tonnage was used principally for agricultural purposes. A small quantity of dimension limestone was produced and used mainly for rough construction and rubble.

The largest producers of limestone, in alphabetical order, were:

Drummond Dolomite, Inc. (Chippewa County)
The Dundee Cement Co. (Monroe County)
The France Stone Co. (Monroe County)
Huron Portland Cement Co. (Alpena County)
Inland Lime & Stone Co. (Mackinac County)
Michigan Limestone Div., United States Steel Corp. (Mackinac and Presque Isle Counties)
Michigan Stone Co. (Monroe County)
Penn-Dixie Cement Corp. (Emmet County)
Presque Isle Corp. (Presque Isle County)
The Wallace Stone Co. (Huron County)

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand: [1]				
Molding	1,693	$2,498	1,518	$2,744
Building	4,427	3,428	4,715	3,706
Paving	5,234	4,694	4,167	3,912
Engine	46	59	(2)	(2)
Fill	2,361	855	1,722	680
Other	43	30	42	24
Undistributed [3]	830	2,014	1,146	2,389
Total	[4] 14,633	13,578	13,310	13,455
Gravel:				
Building	4,343	5,179	4,441	5,362
Paving	20,220	17,194	17,021	14,803
Railroad ballast	112	119	187	193
Fill	307	217	374	228
Other	52	60	215	258
Total	25,034	[4] 22,770	[4] 22,237	20,844
Total sand and gravel	[4] 39,668	36,348	35,547	34,299
Government-and-contractor operations:				
Sand:				
Paving	1,567	882	2,056	1,048
Fill	1,028	408	1,386	474
Other	40	19	86	35
Total	2,635	1,309	[4] 3,529	[4] 1,556
Gravel:				
Building	38	21	139	69
Paving	11,795	9,936	7,610	5,810
Fill	305	105	564	226
Other	163	71	175	68
Total	12,301	10,133	[4] 8,487	6,173
Total sand and gravel	14,936	11,442	12,016	[4] 7,730
All operations:				
Sand	17,268	14,887	16,839	15,012
Gravel	37,335	32,903	30,724	27,018
Grand total	54,603	47,790	47,563	[4] 42,029

[1] Includes friable sandstone.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Includes blast, glass, grinding and polishing, foundry, and other ground and unground industrial sands.
[4] Data do not add to totals shown due to rounding.

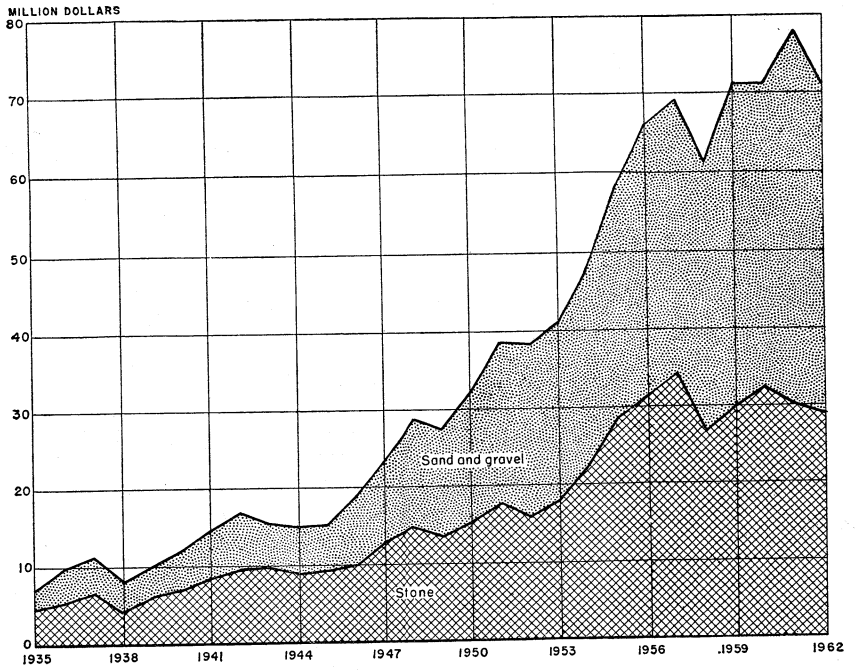

FIGURE 2.—Value of sand and gravel and stone in Michigan, 1935–62.

TABLE 5.—Dimension stone sold or used by producers, by kinds

Year	Limestone		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1958	50,965	$120,361	18,776	$132,981	69,741	$253,342
1959	6,503	58,120	21,779	154,510	28,282	212,630
1960	6,801	58,889	11,615	97,395	18,416	156,284
1961	27,516	119,950	7,045	54,057	34,561	174,007
1962	7,798	51,603	15,223	65,406	23,021	117,009

Basalt for road use was quarried by the county road commission in Dickinson, Houghton, and Ontonagon Counties.

Marl was produced in 16 counties at 36 operations and was used for soil conditioning. The largest output was reported from Allegan, Cass, Calhoun, and Kalamazoo Counties.

Sandstone, used chiefly for flagging and rough construction, was quarried and milled in Baraga and Jackson Counties. The county road commission of Alger and Alcona Counties quarried sandstone for road use and rubble.

Sulfur.—Byproduct sulfur was recovered from crude petroleum in Detroit by the Marathon Oil Co. and at Almaby by the Leonard Refinery Co., Inc.

Vermiculite.—Crude vermiculite, shipped from Montana, South Carolina, and South Africa, was exfoliated at the Dearborn plant of Zonolite Co.

TABLE 6.—Crushed and broken stone sold or used by producers, by kinds and uses

(Thousand short tons and thousand dollars)

Kind and use	1961		1962	
	Quantity	Value	Quantity	Value
Basalt: Concrete aggregate, roadstone: Government-and-contractor	26	$41	73	$73
Limestone:				
Flux	10,565	11,856	10,513	11,069
Concrete aggregate, roadstone:				
Commercial	4,356	4,997	3,431	4,242
Government-and-contractor	293	327	299	367
Agriculture	521	872	485	801
Other: [1]				
Commercial	12,768	11,730	13,459	12,282
Government-and-contractor			1	1
Total commercial	28,210	29,455	[2] 27,887	[2] 28,395
Total Government-and-contractor	293	327	300	368
Total limestone	[2] 28,504	29,782	28,187	28,763
Marl, calcareous: Agriculture	157	100	146	88
Sandstone: Riprap, filler, foundry:				
Commercial	10	7	5	4
Government-and-contractor			6	10
Total commercial	28,377	[2] 29,561	[2] 28,039	28,487
Total Government-and-contractor	319	368	[2] 378	451
Grand total	[2] 28,697	29,929	28,417	28,938

[1] Includes limestone for stone sand (1961), riprap, railroad ballast, chemical uses, whiting or whiting substitutes, asphalt filler, dust for coal mines, mineral food, poultry grit, cement, lime, and other miscellaneous purposes.

[2] Data do not add to totals shown due to rounding.

METALS

Metals accounted for 29 percent of the total value of mineral production, the same proportion as in 1961.

Copper.—Production of copper in terms of recoverable metal was 5 percent larger than in 1961. The value of the output was 8 percent higher than the previous year.

Production was continuous except at the Quincy Mining Co. Its reclamation plant at Hubbell was shut down for 3 months because of an accident. Output was reported from nine underground mines and three tailing reclamation plants.

Calumet & Hecla, Inc. operated six mines, one reclamation plant, and one smelter in Houghton and Keweenaw Counties. Copper Range Co. operated the Champion mine and the Freda mill in Houghton County. The mill concentrated ore from the mine and tailing from the Redridge sands. Concentrate from the mill was processed at the White Pine Copper Co. smelter in Ontonagon County. White Pine Copper Co., a wholly owned subsidiary of Copper Range Co., operated two mines, a mill, and smelter in Ontonagon County. Quincy Mining Co. operated a tailing reclamation plant and a smelter in Houghton County.

The average weighted price of copper increased from 30.0 cents in 1961 to 30.8 cents per pound. The price quoted by primary producers for eletrolytic copper (delivered) at the beginning of 1962 was 31 cents a pound and remained at that price throughout the year.

TABLE 7.—Mine production of copper in 1962, by months, in terms of recoverable metal

Month	Short tons	Month	Short tons
January	6,190	August	6,410
February	5,815	September	5,560
March	6,495	October	6,175
April	6,175	November	6,767
May	6,545	December	6,697
June	5,750		
July	5,520	Total	74,099

TABLE 8.—Mine production of copper, in terms of recoverable metal

Year	Mines producing		Material treated		Copper	
	Lode	Tailing	Ore (short tons)	Tailing (short tons)	Short tons	Value
1953–57 (average)	12	2	4,495,667	1,956,598	43,536	$30,510,937
1958	11	2	5,957,879	1,336,077	58,005	30,510,630
1959	10	3	5,666,533	1,940,455	55,300	33,954,200
1960	9	3	5,600,290	2,192,818	56,385	36,199,170
1961	10	3	7,109,924	2,122,286	70,245	42,147,000
1962	9	3	7,555,357	1,812,530	74,099	45,644,984

Iron Ore.—Shipments of iron ore from Michigan mines increased 38,000 long tons over 1961. The value of shipments declined over 2 percent because of an 80-cent-per-ton price decrease in the Lake Erie base price for standard ores on April 1. A total of 19 underground and 5 open-pit mines were active all or part of 1962, one less underground and two more open-pit mines than in 1961.

Over 50 percent of the ore mined came from open-pit operations, compared to 40 percent in 1961. Average iron content of usable ore was 55.72 percent, natural.

The average weighted mine value of Michigan iron ore, without respect to grade, was $9.08, compared to $9.34 per long ton in 1961.

With the exception of a small quantity of ore used in the manufacture of iron oxide pigments, Michigan iron ore was shipped to producers of pig iron and steel.

About 95 percent of the iron ore was shipped by rail to ore docks in Ashland, Wis., and Escanaba and Marquette, Mich., and then by boats to lower Lake ports. The balance was all-rail shipments to consuming districts.

The Lake shipping season for Michigan ores opened at Escanaba on April 17 and closed at Marquette on December 4.

At yearend, estimated reserves of iron ores in Michigan totaled 96 million long tons,[2] not including about 1.8 billion tons of low-grade hematite ore.

Concentrates produced from jaspilite accounted for over 28 percent of iron-ore shipments and 37 percent of value of shipments in 1962. Capacity for producing and processing this material would be doubled when present and future projects were completed. Construction of the Empire plant, near Palmer, was started in May. The plant was

[2] Geological Survey Division, Michigan Department of Conservation. General Statistics Covering Costs and Production of Michigan Iron Mines. June 1962.

TABLE 9.—Crude iron ore[1] data, in 1962, by counties and ranges

(Thousand long tons)

Country and range	Stocks of crude ore Jan. 1	Production		Shipments		Stocks of crude ore Dec. 31
		Underground	Open pit	Direct to consumers	To beneficiation plants	
County:						
Dickinson			1,185		1,185	
Gogebic	791	1,237		1,480		548
Iron	[2] 1,039	2,878		2,986		931
Marquette	1,987	2,588	5,674	1,090	6,772	2,387
Total[3]	[2] 3,818	6,702	6,859	5,557	7,956	3,865
Range:						
Gogebic	791	1,237		1,480		548
Marquette	1,987	2,588	5,674	1,090	6,772	2,387
Menominee	[2] 1,039	2,878	1,185	2,986	1,185	931
Total[3]	[2] 3,818	6,702	6,859	5,557	7,956	3,865

[1] Exclusive of iron ore containing 5 percent or more manganese, natural.
[2] Revised figure.
[3] Data do not add to totals shown due to rounding.

TABLE 10.—Usable iron ore shipped from mines, by ranges[1]

(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total
1953–57 (average)	5,514	4,144	2,907	12,565
1958	3,722	2,995	1,394	8,111
1959	3,530	2,469	1,249	7,247
1960	4,881	4,018	1,892	10,792
1961	4,141	3,881	1,362	9,384
1962	4,479	3,462	1,480	9,422

[1] Exclusive of iron ore containing 5 percent or more mangenese, natural.

TABLE 11.—Usable iron ore produced, by ranges[1]

(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total
1953–57 (average)	5,659	4,137	2,913	12,709
1958	4,111	2,896	1,397	8,404
1959	2,851	2,616	1,663	7,129
1960	6,619	4,079	2,169	12,866
1961	3,205	4,097	1,062	8,364
1962	4,563	3,460	1,237	9,259
Total 1854–1962	317,203	[2] 262,234	[2] 246,582	826,019

[1] Exclusive of iron ore containing 5 percent or more manganese, natural.
[2] Distribution by range partly estimated before 1906.

to consist of crushing, grinding, concentrating, and pelletizing sections. Initial capacity of the plant, which was scheduled for opening late in 1963, was planned to be 1,200,000 tons of pellets per year from low-grade magnetite. Ultimate capacity was expected to be 3,000,000 tons of pellets per year. The Hanna Mining Co. completed expansion of its Groveland concentrator, increasing its annual capacity from 700,000 to 1.5 million tons. Early in 1962 the company began constructing a pelletizing facility at Groveland that was scheduled for completion in 1963. These additional beneficiating facilities would be capable of producing 1.25 million tons of pellets per year. Cleveland-Cliffs Iron Co. completed the second 800,000-ton-per-year concentration unit at the Republic open-pit mine. A third 800,000-ton unit was under construction and scheduled for completion by yearend. Upon completion of construction, the Republic operation planned to have a capacity of 2.4 million tons of concentrate per year.

Manganiferous Ore.—No manganiferous ore (containing 5 to 35 percent manganese, natural) was shipped in 1962. The Cannon mine in Iron County that had previously produced manganiferous ore was closed on September 20. Its underground equipment was removed, and the mine was allowed to flood.

Pig Iron and Steel.—Pig iron and steel were manufactured in the Detroit metropolitan area. Pig iron shipments increased nearly 7 percent in volume and 15 percent in value over the 1961 figure. Basic and Bessemer grades were produced. According to the American Iron and Steel Institute, Michigan steel production totaled over 7.1 million tons, about 5 percent higher than in 1961.

Silver.—Michigan copper ores normally contain a small amount of silver which has been found desirable for certain uses. Since Michigan copper was usually fire refined, instead of electrolytically refined, silver was seldom recovered. However, during 1962, part of the refined copper having a high silver content was electrolytically refined, which resulted in the recovery of 401,491 ounces, valued at $435,618.

TABLE 12.—Manganiferous iron ore (containing 5 to 10 percent manganese, natural) and ferruginous manganese ore (containing 10 to 35 percent manganese, natural) shipped from mines

Year	Long tons	Year	Long tons
1953–57 (average)	38,421	1960	161,125
1958	100,479	1961	15,253
1959		1962	

MINERAL FUELS

Natural Gas and Natural Gas Products.—Over 60 percent of the State gas production came from oil well gas; the balance came from gasfields. Nearly a third of the output came from fields in St. Clair County, where production quadrupled in 1962. Another third of the production came from the fields of the Albion-Pulaski-Scipio Trend in Calhoun, Hillsdale, and Jackson Counties. Other major gas-producing areas were in Allegan, Missaukee, Roscommon, and Wayne Counties. The above areas yielded 83 percent of the State

total. The remainder came from fields in 20 counties. Six new gasfields were discovered during the year, and three were abandoned. The production of natural gasoline declined, but an increase in the output of liquefied petroleum gases more than offset the drop, and the total value of natural gas products was a third higher than in 1961.

Peat.—Production of peat was about 22 percent higher in volume and 13 percent higher in value than in 1961. Michigan continued to be the leading peat producer with nearly half of the national output. Peat was produced in 16 counties with 95 percent coming from four counties—Lapeer, Oakland, St. Clair, and Sanilac. Peat was sold principally as a soil conditioner, and none was sold as fuel.

Petroleum.—Output of petroleum declined for the first time since 1958 when the rich fields of southern Michigan were developed. A drop in production in this area (Abion-Pulaski-Scipio Trend in Calhoun, Hillsdale, and Jackson Counties) was chiefly responsible for a 9-percent decrease in the State output. This area still accounted for nearly three-fifths of the State total. Production in St. Clair County, which had doubled in 1961, gained less than 20 percent.

According to data published by the Oil and Gas Section, Geological Survey Division, Michigan Department of Conservation, permits for oil and gas tests were down 14 percent (to 658 from 769 in 1961). Footage drilled totaled 1.9 million feet, compared to 2.3 million in 1961. Exploratory footage declined from 1,002,000 in the previous year to 884,000.

St. Clair County continued to be the scene of the greatest drilling activity with 40 oil well and 18 gas well completions.

The Silurian and older sedimentary formations were important in the exploration program. A breakdown of wildcat (exploratory) wells by systems were Precambrian 1, Cambrian 5, Ordovician 48, Silurian 106, Devonian and younger 134; the discoveries by systems were: Silurian 5, Devonian 8, and Mississippian 3.

Petroleum was produced in 45 counties in the lower peninsula. Fourteen operating crude oil refineries had a nominal rated capacity of 190,000 barrels daily.

Fluid injection was used in producing a quarter of the petroleum and an eighth of the gas. Nearly 46 million barrels of fluid, mostly brines, were injected into producing formations through 287 wells. From these same fields, nearly 49 million barrels of fluid, nearly all brine, was produced.

REVIEW BY COUNTIES

Mineral production was reported from all counties in Michigan. The value of output increased in 29 counties and decreased in 54 counties. Output exceeded $1 million in 43 counties. Marquette County led in value of production, as it did in 1961 and 1960.

Allegan.—Sand and gravel, petroleum, and natural gas were the principal minerals produced. Small quantities of marl and peat were reported. Over 1.1 million tons of sand and gravel were mined by nine operators, mostly with portable plants. Natural gas production was sharply curtailed from 6.3 billion cubic feet in 1961 to 1.6 billion. Petroleum production increased moderately to 234,000 barrels.

TABLE 13.—Value of mineral production in Michigan, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value
Alcona	$172,773	$155,617	Sand and gravel, stone.
Alger	143,345	66,532	Do.
Allegan	1,249,805	[2] 1,518,347	Sand and gravel, petroleum, peat, stone, natural gas.
Alpena	(3)	(3)	Cement, stone, clays, sand and gravel.
Antrim	(3)	263,008	Clays, sand and gravel.
Arenac	1,462,102	1,340,990	Petroleum, stone, sand and gravel.
Baraga	393,301	373,653	Iron ore, sand and gravel, stone.
Barry	521,292	411,811	Sand and gravel, petroleum, stone.
Bay	9,654,803	(3)	Cement, petroleum, lime, sand and gravel.
Benzie	----------	32,418	Sand and gravel.
Berrien	981,318	1,044,180	Sand and gravel, stone, peat.
Branch	529,333	184,461	Sand and gravel, stone.
Calhoun	12,085,596	[2] 10,017,935	Petroleum, sand and gravel, stone, natural gas.
Cass	387,090	419,957	Sand and gravel, petroleum, stone.
Charlevoix	62,900	47,568	Sand and gravel, stone.
Cheboygan	220,436	219,351	Do.
Chippewa	5,196,187	4,642,069	Stone, lime, sand and gravel.
Clare	1,831,711	[2] 1,409,580	Petroleum, sand and gravel, natural gas.
Clinton	455,664	452,518	Sand and gravel, clays, peat.
Crawford	808,914	[2] 417,820	Petroleum, sand and gravel, natural gas.
Delta	472,362	287,604	Sand and gravel, stone.
Dickinson	7,272,644	4,189,933	Iron ore, stone, sand and gravel.
Eaton	492,250	490,978	Sand and gravel, stone, clays, peat.
Emmet	11,167,650	9,990,220	Cement, stone, sand and gravel.
Genesee	847,373	634,346	Sand and gravel, petroleum.
Gladwin	1,246,690	1,245,354	Petroleum, sand and gravel.
Gogebic	12,478,611	12,199,452	Iron ore, sand and gravel.
Grand Traverse	(3)	(3)	Sand and gravel.
Gratiot	(3)	(3)	Salines, salt, petroleum, sand and gravel, natural gas.
Hillsdale	12,804,588	[2] 11,576,534	Petroleum, sand and gravel, stone, natural gas.
Houghton [4]	42,453,323	46,494,436	Copper, stone, sand and gravel.
Huron	879,976	995,810	Stone, sand and gravel, lime. petroleum.
Ingham	[5] 833,947	995,837	Sand and gravel, peat.
Ionia	344,552	530,058	Sand and gravel, petroleum.
Iosco	(3)	(3)	Gypsum.
Iron	25,942,454	(3)	Iron ore, sand and gravel.
Isabella	2,217,045	[2] 1,914,020	Petroleum, sand and gravel, stone, natural gas.
Jackson	9,719,086	[2] 7,976,510	Do.
Kalamazoo	817,328	1,187,671	Sand and gravel, stone, peat, petroleum.
Kalkaska	223,985	[2] 263,448	Sand and gravel, pertoleum, natural gas.
Kent	3,432,473	[2] 2,802,534	Sand and gravel, gypsum, petroleum, peat, natural gas.
Keweenaw	(6)	(6)	Copper, sand and gravel.
Lake	95,313	(3)	Sand and gravel, petroleum.
Lapeer	1,064,994	1,239,625	Peat, sand and gravel, salines, petroleum.
Leelanau	159,773	66,978	Sand and gravel.
Lenawee	3,134,742	1,915,866	Cement, sand and gravel, clays, petroleum, peat.
Livingston	2,665,880	[2] 3,674,134	Sand and gravel, natural gas.
Luce	31,235	14,420	Sand and gravel.
Mackinac	(3)	(3)	Stone, sand and gravel.
Macomb	878,618	[2] 935,991	Sand and gravel, petroleum, natural gas.
Manistee	[5] 12,712,178	13,760,826	Salines, salt, sand and gravel.
Marquette	43,414,822	(3)	Iron ore, sand and gravel.
Mason	(3)	(3)	Salines, lime, sand and gravel, petroleum, natural gas.
Mecosta	237,705	[2] 209,192	Sand and gravel, petroleum, stone, natural gas.
Menominee	1,133,396	824,964	Lime, sand and gravel.
Midland	(3)	(3)	Salines, salt, petroleum, sand and gravel, natural gas.
Missaukee	2,465,567	[2] 1,883,808	Petroleum, sand and gravel, natural gas.
Monroe	(3)	(3)	Cement, stone, clays, petroleum, peat, sand and gravel.
Montcalm	1,755,878	[2] 1,481,155	Petroleum, sand and gravel, peat, natural gas.
Montmorency	208,276	(3)	Sand and gravel, petroleum.
Muskegon	1,910,920	[2] 1,785,779	Sand and gravel, salt, petroleum, natural gas.
Newaygo	231,398	[2] 225,151	Sand and gravel, petroleum, stone, natural gas.
Oakland	6,078,686	[2] 6,181,348	Sand and gravel, peat, petroleum, natural gas.
Oceana	863,116	[2] 898,659	Petroleum, sand and gravel, natural gas.
Ogemaw	1,412,817	[2] 1,190,998	Do.
Ontonagon	(6)	(6)	Copper, silver, sand and gravel, stone.
Osceola	1,721,843	[2] 1,257,386	Petroleum, sand and gravel, stone, natural gas.
Oscoda	23,025	25,789	Sand and gravel, petroleum.
Otsego	1,085,806	[2] 39,982	Sand and gravel, natural gas.
Ottawa	2,031,077	[2] 2,141,762	Sand and gravel, petroleum, stone.
Presque Isle	(3)	(3)	Stone, sand and gravel.
Roscommon	1,256,706	[2] 761,597	Petroleum, sand and gravel, natural gas.
Saginaw	603,724	387,524	Clays, petroleum, lime, sand and gravel.

See footnotes at end of table.

TABLE 13.—Value of mineral production in Michigan, by counties[1]—Continued

County	1961	1962	Minerals produced in 1962 in order of value
St. Clair	$15,904,394	[2] $16,330,653	Salt, petroleum, cement, peat, sand and gravel, clays, natural gas.
St. Joseph	(3)	215,158	Sand and gravel, stone, peat.
Sanilac	563,388	1,105,411	Peat, sand and gravel, lime.
Schoolcraft	262,067	146,662	Sand and gravel.
Shiawassee	547,484	302,044	Sand and gravel, clays.
Tuscola	1,959,030	1,895,629	Sand and gravel, petroleum, lime, peat.
Van Buren	342,378	371,753	Sand and gravel, petroleum, stone.
Washtenaw	3,652,860	[2] 1,267,648	Sand and gravel, petroleum, peat, natural gas.
Wayne	40,031,488	[2] 39,834,025	Cement, salt, lime, sand and gravel, stone, clays, petroleum, natural gas.
Wexford	64,983	79,948	Sand and gravel.
Undistributed [7]	[5] 130,344,001	139,712,985	
Total	[5] 450,652,000	446,520,000	

[1] Gem stones and natural gas liquids not listed by counties as data are not available, included with "Undistributed."
[2] Excludes value of natural gas.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Includes value of mineral production in Keweenaw and Ontonagon Counties.
[5] Revised figure.
[6] Value of mineral production is included in that of Houghton County.
[7] Includes petroleum (1961), some sand and gravel not assigned to specific counties, and values indicated by footnotes 1, 2, and 3.

Alpena.—Portland and masonry cements were manufactured in Alpena by Huron Portland Cement Co. A large rotary kiln, 460-feet long, started producing. The dry-process kiln was the largest in the State having a capacity of 5,200 barrels of clinker per day. Highly automated, the entire operation could be electronically controlled by one man. The Alpena mill also completed a $2 million reduction-drying system for the shale and stone used in cement manufacture. The equipment was able to handle 500 tons per hour of shale or limestone and eliminated the screen house, the tertiary crusher, and six rotary dryers and impactors. The system received minus 5-inch stone from the secondary crusher in the quarry, reduced it to ⅜ inch, and removed 95 percent of the moisture.

Sand and gravel for road use, and clay and limestone for cement were produced in the Alpena area.

Antrim.—Shale was mined from the Ellsworth quarry by Penn-Dixie Cement Co. for use at its Petoskey plant. Road materials were mined from county sand and gravel pits for use of the county road commission and the Michigan State Highway Department.

Arenac.—The Deep River and Sterling fields continued to produce the major part of the petroleum output. County petroleum production declined by 49,000 barrels to 367,000 barrels Roadstone was quarried by the Arenac, Bay, and Iosco County Highway Departments. Sand and gravel for building and road use was produced at several sites.

Baraga.—Cleveland-Cliffs Iron Co.'s Ohio mine was idle during 1962 and was still closed on December 31. Some iron ore was shipped from stocks. Sandstone for building use was quarried at Arnheim by Superior Natural Red Stone Co. Sand and gravel for road use was produced from a pit near L'Anse and by portable plants throughout the county.

Barry.—Marl for agriculture was produced from the Duncan Lake pit southwest of Caledonia and from a pit near Nashville. Sand and gravel for building and road use, ice control, and fill was produced

from several pits. A small quantity (16,000 barrels) of petroleum was produced, mostly from the Hope Field.

Bay.—Aetna Portland Cement Co. produced masonry and portland cements at Bay City. Late in 1962 the 3-million-barrels capacity plant was sold to Martin Marietta Corp. Monitor Sugar Division of the Robert Gage Coal Co. produced lime for its own use in sugar refining. Over 400,000 barrels of petroleum was produced, chiefly from the Essexville and Kawkawlin fields. Gravel for road use was produced.

Berrien.—Molding sand, as well as building and road materials, were produced from several sand and gravel pits in the county. Marl for agricultural use was dug from two pits near Three Oaks. A small quantity of humus peat was produced near Bainbridge.

Branch.—Nearly 300,000 tons of sand and gravel was produced for building, paving, and fill. Production came from two fixed plants near Coldwater and several portable plants operating throughout the county. Marl was dug from a lake near Sherwood and sold for agricultural purposes.

Calhoun.—The county held second place in petroleum production, although output declined by half a million barrels. Natural gas production increased from 2.9 billion in 1961 to 3.6 billion cubic feet. Over 370,000 tons of sand and gravel was produced for building and road use and fill. Marl was dug from pits near Union City and Burlington and sold for agricultural use.

Cass.—Petroleum production, from the Jefferson field, doubled that of 1961 to 42,000 barrels. During 1962, 25 oil wells were drilled resulting in 6 producing wells and 19 dry holes. Sand and gravel was produced by five operators. Marl was produced from five pits near Dowagiac, Cassopolis, and Jones.

Charlevoix.—A limestone quarry near Charlevoix was operated by Charlevoix Lime & Stone Co. Roadstone, agricultural limestone, fluxstone, and a small quantity of rough construction stone was produced. Road materials were produced from sand and gravel pits for the county and State highway departments.

Cheboygan.—Afton Stone & Lime Co. quarried limestone for road use at Afton. Nearly 400,000 tons of sand and gravel, mainly for highway construction, was produced.

Chippewa.—Limestone for flux, roadstone, and agricultural limestone was quarried and crushed at quarries on Drummond Island, in Lake Huron, by Drummond Dolomite, Inc. Over 1 million tons of sand and gravel, much of it for road use, was produced from pits throughout the county.

Clare.—Nearly half a million barrels of petroleum and half a billion cubic feet of natural gas were produced. Most of the oil and gas came from the Hamilton and Headquarters fields. A small quantity of sand and gravel was produced for the Michigan State Highway Department.

Clinton.—Clay for the manufacture of sewer pipe was mined by Grand Ledge Clay Products Co. and American Vitrified Products Co. Humus peat was mined from a bog near Ovid. About 500,000 tons of sand and gravel were produced, mostly for building and paving use.

Crawford.—The Beaver Creek field (Crawford County portion) yielded 134,000 barrels of petroleum and over 650 million cubic feet of

natural gas. The county road commission produced sand and gravel for its own use.

Delta.—Bichler Bros., Escanaba, quarried and crushed limestone for road use and mined sand and gravel for building and highway use. Sand and gravel, mostly for road construction, was produced at several pits in the Gladstone area, as well as in other sections of the county.

Dickinson.—The Hanna Mining Co. operated the Groveland open-pit iron mine and concentrator near Randville. Limestone was quarried near Felch and shipped to a mill in Wisconsin where it was processed and sold as a filler for paint and putty. Superior Rock Products Co. operated a quarry near Randville and produced limestone for use in terrazzo and ornamental concrete. Sand and gravel was produced for building and road use.

Eaton.—Grand Ledge Clay Products Co. mined miscellaneous clay near Grand Ledge for the manufacture of sewer pipe. Cheney Limestone Co. operated a quarry near Bellevue and produced roadstone, agricultural limestone, and rubble. Hilu Peat Co. dug humus peat from a bog near Charlotte. Sand and gravel for fill and building and paving purposes was produced throughout the county, mostly with portable plants.

Emmet.—Penn-Dixie Cement Corp. produced masonry and portland cements at Petoskey. The company quarried limestone near the plant for use in manufacturing cement. Sand and gravel was produced for both the State and county highway departments.

Genesee.—A small quantity (2,800 barrels) of petroleum was produced from the Otisville field. Over 700,000 tons of sand and gravel was sold for building and paving purposes, fill, and miscellaneous uses.

Gladwin.—Petroleum production of 435,000 barrels was up slightly from 1961 (427,000 barrels). The largest output came from the North Buckeye field among the 12 fields reporting production. Road gravel was produced for the State highway department.

Gogebic.—North Range Mining Co. completed stockpile shipments of iron ore in October. The company Penokee mine (underground) was closed late in 1961. Pickands Mather & Co. operated the Geneva-Newport and Peterson mines. Sand and gravel production (354,000 tons) was about half the 1961 output because the State highway department requirements for road construction materials in the area were substantially reduced.

Gratiot.—Michigan Chemical Co. produced bromine, calcium chloride, magnesium compounds, and salt from natural well brines at St. Louis. Sand and gravel for fill, building, and road use was produced by five operators. Petroleum was produced from the Sumner field and natural gas from the North Star field. Crude oil was refined at Alma by Leonard Refineries, Inc. Byproduct sulfur was recovered at the refinery.

Hillsdale.—The county again led the State in petroleum production, although output (3.9 million barrels) was down from that of 1961 (4.2 million barrels). Natural gas output increased 264 million cubic feet to over 3.2 billion cubic feet. Pits near Mosherville and Allen yielded marl for agricultural use. The Canary Hill sandstone quarry

of Paul Krick, near Hillsdale, did not operate in 1962. Nearly half a million tons of sand and gravel was produced at several sites.

Houghton.—Copper was produced by Calumet & Hecla, Inc., Copper Range Co., and Quincy Mining Co. Calumet & Hecla operated the Allouez, Centennial No. 2, Centennial No. 3, Peninsula, Seneca, and Osceola No. 13 mines. There was considerable exploration of the Kingston conglomerate by surface drilling and underground diamond drilling. Copper Range operated the Champion mine throughout 1962. Ore from the Champion mine and tailing from the Redridge sands were treated at the Freda mill. Concentrates were processed at the White Pine Smelter in Ontonagon County. Quincy Mining Co. operated a reclamation plant at Hubbell and a smelter at Hancock. The operation was shutdown from May 31 to September 3 because of the collapse of an ore bin in the reclamation plant on May 31. Two men were killed and two were injured in the accident. Basalt was quarried by the county road commission for its own use. Sand and gravel for building and highway use was produced.

Huron.—Michigan Sugar Co. produced hydrated lime at its Sebewaing plant for use in refining sugar. The Wallace Stone Co. quarried limestone at Bayport. Roadstone, railroad ballast, agricultural limestone, and rough construction stone were produced. Sand and gravel, principally for road use, was produced at several sites. A small quantity of petroleum was produced from the Dwight and Grant fields.

Ingham.—Moss peat was produced by the West Lansing Gravel Co. for horticultural use. Over 1.25 million tons of sand and gravel was produced. The Lansing Board of Power & Light recovered lime from calcium carbonate precipitated in the water purification process.

Ionia.—About 1,000 barrels of petroleum was recovered from that part of Bloomer field lying in Ionia County. Over 670,000 tons of sand and gravel was produced at several sites, and was used mainly for road construction.

Iosco.—Gypsum was the only mineral mined. National Gypsum Co. operated a quarry near Tawas City and a processing plant at National City. The company also expanded perlite at this location from crude ore shipped in from Colorado. United States Gypsum Co. operated a quarry near Alabaster. Michigan Gypsum Co. began operating a quarry 3 miles south and 2 miles east of Whittemore in Burleigh Township on July 15.

Iron.—The Hanna Mining Co. operated the Cannon, Hiawatha, Homer, and Wauseca mines; Inland Steel Co. operated the Bristol and Sherwood mines; and Republic Steel Corp. operated the Tobin Group. Only stockpile shipments were made from the Buck Unit mine of Pickands Mather Co. The mine was closed in 1961. The Book mine of North Range Mining Co. was idle throughout 1962. Road gravel was produced for the county and State highway departments.

Isabella.—The decline in petroleum and natural gas production continued. Natural gas volume dropped from 269 million to 107 million cubic feet, and the petroleum output of 487,000 barrels was 134,000 barrels less than in 1961. Crude oil was refined at Mount Pleasant by Leonard Refineries, Inc. Marl was produced near Weidman by the Gatehouse Brothers. County pits yielded 765,000 tons of sand and gravel.

Jackson.—Petroleum output declined by over 500,000 barrels to 2.6 million barrels. Natural gas production was 2.2 billion cubic feet, compared with 2.4 billion in 1961. Sandstone was quarried near Napoleon at three sites. It was milled for building use and crushed for riprap, fill, and foundry use. Marl was dug from a pit near Horton. Limestone was quarried and crushed near Parma for roadstone, concrete aggregate, and agricultural use. Over 500,000 tons of sand and gravel was produced, mostly for building and paving use.

Kalamazoo.—Peat (reed-sedge and moss) was dug from bogs near Kalamazoo and Scotts. Marl, for agricultural use, was dug at six sites. The largest quantity came from the Vicksburg area. Nearly 1 million tons of sand and gravel was produced. A few barrels of oil were recovered from the Alamo field, which was abandoned during 1962. Crude oil was refined at the Lakeside Refinery in Kalamazoo.

Kalkaska.—Natural gas and petroleum were obtained from the Kalkaska County part of the Beaver Creek field. Sand and gravel pits yielded road materials for the county and State highway departments.

Kent.—Underground gypsum mines near Grand Rapids were worked by Bestwall Gypsum Co. and Grand Rapids Plaster Co. The crude gypsum was processed at company-owned plants where wallboard, lath, sheathing, and plaster were produced. Over 2 million tons of sand and gravel was produced, mostly in the Grand Rapids area. Gregg Products Co. and Bestwall Gypsum expanded perlite obtained from Western States. The processed material was sold or used for plaster, concrete aggregate, and soil conditioning. Peat was produced at four sites in the Grand Rapids area. Natural gas and petroleum were produced from the Walker field.

Lake.—About 6,000 barrels of petroleum were produced, mainly from the Reed City field (Lake County portion). Road gravel and sand for highway ice control was obtained from pits in the county.

Lapeer.—Wilkinson Chemical Corp., Mayville, produced calcium chloride and calcium-magnesium chloride from natural well brines. Reed-sedge peat was produced at four operations near Imlay City. About 400,000 tons of sand and gravel, mostly for highway construction, was produced. A new oil field, Richfield, was opened and produced 1,528 barrels of petroleum.

Lenawee.—Masonry and portland cements were produced at Cement City by Peninsular Portland Cement Div., General Portland Cement Co. Comfort Brick & Tile Co., Tecumseh, mined clay for manufacturing draintile. Tecumseh Peat Co. produced humus peat near Adrian. Nearly 800,000 tons of sand and gravel was produced by eight operators.

Mackinac.—Large limestone quarries were operated near Cedarville by Michigan Limestone Division, United States Steel Corp. and at Manistique by Inland Lime & Stone Co., a division of Inland Steel Co. Extensive processing plants and port facilities had been developed at each operation. Much of the output was shipped by boat to industrial consumers. Production increased over 1961 because of greater demand for blast furnace flux. Limestone was also shipped to cement plants, lime plants, sugar mills, paper mills, and other industrial consumers. Production of sand and gravel more than doubled from

285,000 in 1961 to 661,000. Most of the material was used for highway construction.

Macomb.—Over 1.1 million tons of sand and gravel were produced at pits throughout the county. Two-thirds of the material was from stationary plants, and the remainder came from portable operations. Principal uses were for building, road construction, and fill. Over 500 million cubic feet of natural gas was produced, nearly all from the Lenox field. Chesterfield and Lenox fields yielded a small quantity of petroleum.

Manistee.—Bromine, calcium chloride, and magnesium compounds were extracted from natural well brines of the Filer formation. In the Manistee area Great Lakes Chemical Co., Michigan Chemical Co., Morton Chemical Co., and Standard Lime & Cement Co., Division of Martin Marietta Corp. operated chemical plants. Value of output was nearly 15 percent larger than in 1961. Salt was recovered from artificial brines by Manistee Salt Works and Morton Salt Co. Industrial sand (molding, grinding, and polishing) and sand and gravel for building and paving purposes were produced at several sites.

Marquette.—Cleveland-Cliffs Iron Co. produced iron ore at eight mines. The Lloyd mine was idle the entire year, but shipments were made from stocks. Tonnage produced at the new Empire mine was used for experimental testing, and commercial production was anticipated in 1963. Inland Steel Co., Jones & Laughlin Steel Corp., and North Range Mining Co. each operated one mine. Overall shipments of iron ore from the county increased by 26 percent. Output of underground mines was 10 percent lower than in 1961. Production from open-pit mines increased by two-thirds chiefly because of the expansion of facilities for processing low-grade jaspilite ore. Over 1 million tons of sand and gravel was produced in the county, a large share of the material being used in road construction.

Mason.—The Dow Chemical Co. operated plants in the Ludington area to produce bromine, calcium chloride, magnesium compounds, and lime. Harbison-Walker Refractories Co. produced refractory magnesia from purchased magnesium hydroxide. Industrial sand (foundry, grinding, and polishing) was mined near Ludington. Road materials for the county and State highway departments were produced from county sand and gravel pits. Petroleum output increased to 168,000 barrels from 91,000 in 1961. Nearly 18 million cubic feet of natural gas was produced in the Eden field.

Mecosta.—Marl was produced from two pits near Mecosta and sold for agricultural use. About 31,000 barrels of petroleum and 150 million cubic feet of natural gas was recovered from eight fields. Sand and gravel production was reported by two commercial operators and by county and State agencies.

Menominee.—Limestone Products Division, North Western-Hanna Fuel Co. produced quicklime and hydrated lime for industrial and chemical use. Over 660,000 tons of sand and gravel was produced, mostly for road construction.

Midland.—The Dow Chemical Co. produced bromine, calcium chloride, iodine, magnesium compounds, potash from natural brines, and salt from artificial brines. Late in 1962, The Dow Chemical Co. announced plans to build the first bulk chemical plant using atomic radia-

tion. Ethyl bromide was to be produced using emissions from radioactive cobalt as a catalyst. The final product would be free from radioactivity. Kaiser Aluminum & Chemical Co. produced refractory magnesia from purchased magnesium hydroxide. The output was used in the company refractories plant in Ohio. About 290,000 barrels of petroleum and 14 million cubic feet of natural gas were recovered. Molding sand and sand and gravel for road use were produced.

Missaukee.—Petroleum production totaled 659,000 barrels, and the natural gas output was about 1 billion cubic feet. Most of the oil came from the East Norwich and McBain fields and the gas came from East Norwich and Enterprise fields. Gravel was produced for the county highway department.

Monroe.—Dundee Cement Co., Dundee, manufactured masonry and portland cements. Clay and limestone deposits adjacent to the mill were used for raw materials. F. W. Ritter Sons Co. produced art pottery from clay mined near South Rockwood. Limestone for riprap, roadstone, ballast, and agricultural limestone was produced at four quarries. Road gravel was produced for the State highway department. Bogs near Ida and Petersburg yielded peat that was sold for soil conditioning. The Deerfield field yielded about 22,000 barrels of petroleum.

Montcalm.—About 350,000 tons of sand and gravel, all for road use, was produced at several sites. Reed-sedge and moss peat were dug near Lakeview. Both petroleum and natural gas declined from 528,000 barrels and 384 million cubic feet in 1961 to 461,000 barrels and 239 million cubic feet. The Edmore and Reynolds fields continued to supply the major portion of the production. The Crystal Refining Co. at Carson City refined crude oil.

Muskegon.—Salt was produced from artificial brines at Montague by Hooker Electrochemical Co. Sand deposits in the Muskegon area yielded large quantities of industrial sands, chiefly engine and molding sand. Sand and gravel for road use was also produced. Nearly 18,000 barrels of oil and 8 million cubic feet of gas were recovered from seven fields.

Newaygo.—The Ensley gas field yielded 180 million cubic feet of natural gas, and 38,000 barrels of petroleum was recovered from six fields. Marl for agricultural use was dug near Grant. Sand and gravel for building and highway use was produced.

Oakland.—About 6.4 million tons of sand and gravel was produced. Most of the output was used for building and road construction in the Detroit area. Humus peat was produced at four sites. Oil and gas was recovered from the Northville field.

Oceana.—Seven fields yielded 273,000 barrels of petroleum and 8 million cubic feet of natural gas. Principal production came from the Elbridge and Stony Lake fields. Sand and gravel for building and road use was produced.

Ogemaw.—The Rose City and West Branch fields contributed the major portion of the county oil and gas production. Nearly 200,000 barrels of petroleum and 720 million cubic feet of natural gas were recovered. Sand and gravel for road use was produced.

Ontonagon.—Copper was mined, milled, and smelted by White Pine Copper Co. (a wholly owned subsidiary of Copper Range Co.). Toward the end of 1962 the mill output exceeded the capacity of the smelter. Two new rod mills were being added to increase mill capacity by 10 percent. Improvements in drying the concentrate were expected to improve smelter capacity by 10 to 15 percent. A silver recovery circuit was installed in the mill. High-silver-bearing concentrates from this circuit were smelted separately for delivery to electrolytic refineries where the silver could be recovered. A semicontinuous casting unit delivered to the smelter in December would increase utilization of Lake copper by providing shapes which are sold at a premium. Two new access and ventilation shafts were put into operation at the White Pine mine. Development of the southwest ore body continued. Further mining research was to be undertaken in reference to the ore body before mining would begin. Copper Range Co. and Calumet & Hecla, Inc. exchanged 99-year leases on lands in upper Michigan. By consolidating holdings, each company's exploration potential was increased. Over 200,000 tons of sand and gravel for road use was produced. The county road commission quarried a small tonnage of basalt for road use.

Osceola.—Petroleum production declined by about 100,000 barrels to 374,000 barrels. Natural gas output also dropped in 1962 and totaled 291 million cubic feet. A major portion of the oil and gas came from the Reed City field. Crude oil was refined at Reed City by Osceola Refining Co. Marl was produced from pits near Marion and Tustin. About 250,000 tons of sand and gravel was produced.

Ottawa.—Sand and gravel output totaled 1.8 million tons, 300,000 tons more than in 1961. In addition to road materials, considerable tonnages of industrial sand and sand and gravel for building purposes was produced. Marl was dug near Jenison and Hudsonville for agricultural use. About 175,000 barrels of petroleum, 20,000 barrels less than in 1961, was recovered. Most of the production came from the Walker field.

Presque Isle.—Michigan Limestone Division, United States Steel Corp. and Chemstone Corp., Division of Minerals & Chemicals Philipp Corp. (operators for Presque Isle Corp.) operated huge quarries, processing plants, and ports at Rogers City and Alpena. The limestone output of the county was exceeded by only a dozen States. Most of the shipments were by water to steel mills, cement, chemical and lime plants, and sugar and paper mills. Large quantities were also sold for concrete aggregate, roadstone, and for agricultural purposes. Onaway Stone Co. quarried and milled limestone for building use. Sand and gravel was mined and processed by Straits Aggregate & Equipment Corp. for building and road use. The county road commission produced road materials.

Roscommon.—Over 1.2 billion cubic feet of natural gas and 217,000 barrels of petroleum were produced. Headquarters and St. Helen's fields yielded the major portion of production. Sand and gravel production totaled 300,000 tons, half a million tons less than in 1961. Completion of highway projects was responsible for the decline.

Saginaw.—Aetna Portland Cement Co. mined clay for its own use. Minco Products Corp. sold clay for drilling mud, fertilizer, and

foundry use. Michigan Sugar Co. produced hydrated lime for sugar refining at Carrollton. Petroleum was produced mostly from the Birch Run and Saginaw fields. Bay Refining Corp. refined crude oil at Saginaw. The State highway department contracted for road gravel from county pits.

St. Clair.—Peerless Cement Co., Division of American Cement Corp., produced masonry and portland cements at Port Huron. The company mined clay for use at the plant. Diamond Crystal Salt Co. and Morton Salt Co. recovered salt from artificial brines. Reed-sedge peat was produced near Capac. Over 460,000 tons of sand and gravel was mined from pits throughout the county. Most of it was used for road construction. Petroleum production increased to 968,000 barrels from 816,000 in 1961, and natural gas output quadrupled to 9.2 billion cubic feet from 2.3 billion in 1961.

St. Joseph.—Marl was produced from three pits near Three Rivers and Nottawa. A bog near Three Rivers yielded moss and reed-sedge peat. Sand and gravel production was reported by three operators. The State highway department contracted for sand and gravel for road construction.

Sanilac.—Michigan Sugar Co. produced hydrated lime for use in refining sugar at its Croswell plant. Peat was produced near Sandusky and Minden City. Nearly 400,000 tons of sand and gravel was produced, practically all for road construction.

Shiawassee.—Vitrified sewer pipe was manufactured from clay mined near Corunna by Michigan Vitrified Tile Co. Over 275,000 tons of sand and gravel was mined by three operators.

Tuscola.—At Caro the Michigan Sugar Co. produced hydrated lime for its own use, and the Rushland Peat Co. mined and packaged peat for horticultural use. Over 1.4 million tons of sand and gravel was produced. In addition to building and paving material, a considerable quantity of industrial (molding) sand was produced. About 85,000 barrels of petroleum, principally from the Akron field, was produced.

Van Buren.—About 18,000 barrels of petroleum was produced, mainly from the Bloomingdale and Lawton fields. About 366,000 tons of sand and gravel was produced. Although the bulk of the material was for road use, some industrial sand was mined at two pits. A small amount of marl was obtained from the Lune Lake Marl Pit.

Washtenaw.—Sand and gravel output totaled over 1.2 million tons. Completion of road projects in the area reduced demand substantially. Reed-sedge peat was dug from a bog near Ypsilanti. The county portion of the Northville field yielded about 35,000 barrels of petroleum and 700 million cubic feet of natural gas.

Wayne.—The county dropped to third place in value of minerals produced. Mineral production was about the same as in 1961. Peerless Cement Co., Division of American Cement Corp., manufactured portland and masonry cement at two plants in Detroit. The company mined clay for its own use locally. Wyandotte Chemicals Corp. produced portland cement at Wyandotte. Flat Rock Clay Products Co. mined clay for use in manufacturing draintile. Lightweight Aggregates Corp. mined clay at Livonia for its own use. Quicklime was produced in Detroit by Solvay Process Division of Allied Chemical

Corp. and in Wyandotte by Wyandotte Chemicals Corp. Most of the output was used by the producers in chemicals manufacture. Salt was produced from the underground mine of International Salt Co. in Detroit and recovered from artificial brines at Wyandotte by Pennsalt Chemicals Corp. and Wyandotte Chemicals Corp. Limestone for road use was quarried from the Sibley quarry at Trenton by Michigan Foundation Quarry Co. Over 2 million tons of sand and gravel was produced from pits in the Detroit area. In addition to building and paving material, a large quantity of industrial sand (principally glass and molding sand) and fill material was mined. Natural gas and petroleum production from the Northville field was about the same as in 1961. Byproduct sulfur was recovered from petroleum by the Parsons process at the Detroit plant of Marathon Oil Co. Crude oil refineries were operated at Detroit by Marathon Oil Co., at Flat Rock by Petroleum Specialties, Inc., at Trenton by Socony-Mobil Oil Co., Inc., and at Wyandotte by Wyandotte Chemicals Corp. Crude vermiculite was exfoliated at the Dearborn plant of Zonolite Co. The crude material came from Montana, South Carolina, and the Republic of South Africa.

707-634—63——37

The Mineral Industry of Minnesota

By Matthew G. Sikich [1] and L. F. Heising [2]

MINERAL production in Minnesota was valued at $428.9 million, a 5-percent decrease from 1961. Chief reason for the decline was the drop in value of iron-ore shipments, caused primarily by the 80-cent-per-ton reduction in Lake Erie base prices for standard ores. Decreases in total value of production were recorded for all mineral commodities except abrasive stones, manganiferous ore, peat, and stone. Iron-bearing ores (including manganiferous ore) continued to furnish the bulk of the State total mineral value, comprising 90 percent of the total.

The Area Redevelopment Administration (ARA) sponsored direct-reduction process tests and plant feasibility studies. Krupp-Renn direct-reduction tests on Cuyuna and Mesabi Range iron ores were completed, and a plant feasibility study was initiated. R–N direct-reduction tests on Cuyuna and Mesabi ores were in progress in 1962. W. S. Moore Co. was granted funds by the ARA and the Iron Range Resources and Rehabilitation Commission (IRRRC) to build an iron-ore-briquetting plant to study utilization of fine ores that are presently undesirable for use in blast furnaces.

TABLE 1.—Mineral production in Minnesota [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays, thousand short tons	[2] 176	[2] $241	203	$291
Iron ore (usable), thousand long tons, gross weight	44,699	407,152	44,295	385,997
Manganiferous ore (5 to 35 percent, Mn), short tons, gross weight	181,835	[3]	292,779	[3]
Peat, short tons	11,091	181	12,934	307
Sand and gravel, thousand short tons	30,690	24,143	29,399	22,656
Stone, do	3,957	9,975	3,803	10,360
Value of items that cannot be disclosed: Abrasive stones, cement, fire clay (1961), gem stones, lime, and values indicated by footnote 3		[4] 9,222		9,325
Total		[4] 450,914		428,936

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay included with "Value of items that cannot be disclosed."
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Revised figure.

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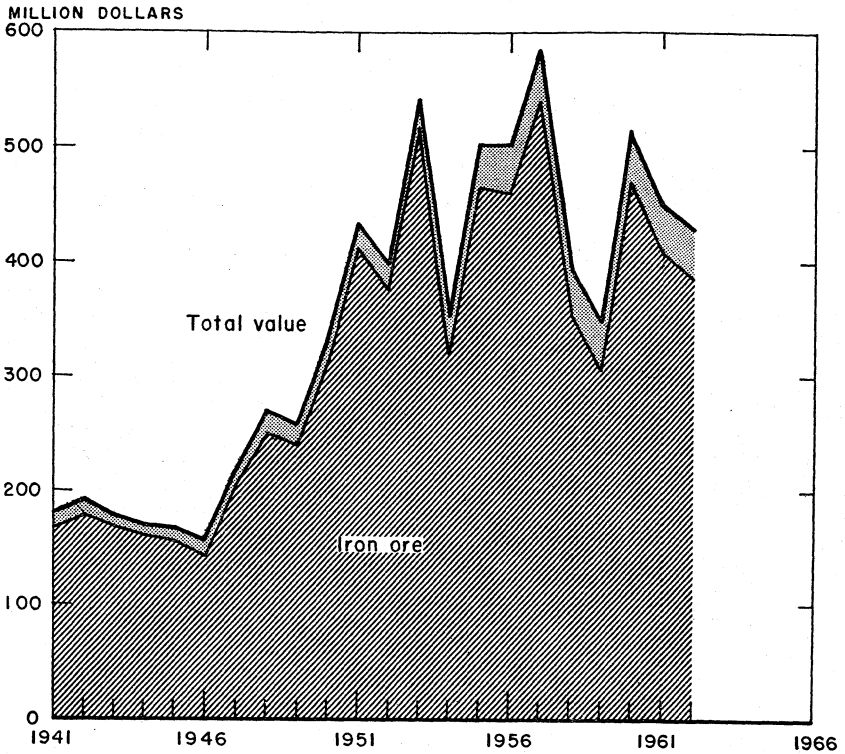

FIGURE 1.—Value of iron-ore shipments and total value of all minerals produced in Minnesota, 1941–62.

Employment and Injuries.—Over 26.9 million man-hours were worked in Minnesota mineral industries in 1962, excluding officeworkers, compared with 29.6 million man-hours in 1961. The 9-percent drop was attributed primarily to employment decreases in the iron ore, sand and gravel, and stone industries.

Three fatalities, one each at iron ore, limestone, and sand and gravel operations, occurred in 1962, compared with five the previous year. The number of nonfatal disabling injuries was 241 (preliminary figure), compared with 287 (final figure) in 1961.

The Sherman mine of Oliver Iron Mining Division of United States Steel Corp. won the Sentinels of Safety Trophy, the top award, in the open-pit group of the 1962 National Safety Competition. The mine, located near Chisholm worked 716,563 man-hours in 1962 without a disabling work injury. Other Minnesota mines and plants experienced injury-free records in 1962 and received Certificates of Achievement in Safety from the Federal Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

METALS

Iron Ore.—Shipments of usable iron ore (excluding ore containing 5 percent or more manganese, natural) were 44.3 long tons, a 1-percent decrease from 1961 shipments. However, the percentage of bene-

ficiated included in total usable ore increased from 71.7 to 74.1 percent. A 3-percent decrease from the 1961 record shipments of taconite concentrates brought the taconite shipments to 14.0 million tons. Minnesota continued to rank first in iron-ore production, supplying 63 percent of the total usable iron ores shipped from mines in the United States in 1962.

Iron ore was produced in St. Louis, Itasca, Crow Wing, Fillmore, and Olmsted Counties by 18 mining companies. Of the total usable ore shipments, 95 percent was from the Mesabi Range in St. Louis and Itasca Counties, 2 percent from the Vermilion Range in St. Louis County, 2 percent from the Cuyuna Range mines in Crow Wing County and the remainder was from the Spring Valley district (Fillmore and Olmsted Counties).

Shipments of taconite pellets decreased slightly from the record high in 1961 although actual production increased. Reserve Mining Co. and Erie Mining Co. (Pickands Mather & Co., operating agent) operated their large-scale taconite-processing plants at Silver Bay and Hoyt Lakes, respectively, at record production rates, except for a 9-day shutdown of the Reserve plant in midsummer due to a labor dispute. The $120 million major-construction program of the Reserve Mining Co. to expand its annual capacity to 9 million tons of pellets was expected to be completed ahead of schedule in January 1963. Erie Mining Co. studied the feasibility of up-grading magnetite concentrate by

TABLE 2.—Dates of first and final cargoes of iron ore at United States upper Great Lakes ports

Port and dock	1961		1962	
	First	Final	First	Final
Ashland, Wis.:				
C&NW	May 11	Nov. 20	May 9	Nov. 9
Soo Line	May 11	Nov. 20	May 9	Nov. 9
Duluth, Minn.: DM&IR	May 16	Nov. 1	May 12	Oct. 23
Escanaba, Mich.: C&NW	Apr. 25	Nov. 25	Apr. 17	Nov. 25
Marquette, Mich.:				
Soo Line	May 20	Nov. 15	May 2	Nov. 8
LS&I	Apr. 24	Dec. 4	Apr. 21	Dec. 4
Silver Bay, Minn.: Reserve	Apr. 15	Dec. 3	Apr. 18	Nov. 24
Superior, Wis.:				
GN	Apr. 24	Dec. 3	Apr. 21	Nov. 27
NP-Soo Line	May 4	Nov. 7	Apr. 24	Nov. 16
Taconite Harbor: Erie	May 9	Nov. 30	Apr. 17	Dec. 13
Two Harbors, Minn.: DM&IR	May 1	Nov. 24	Apr. 20	Nov. 7

Source: Skillings' Mining Review.

TABLE 3.—Usable iron ore[1] produced (direct-shipping and all forms of concentrate), by ranges

(Thousand long tons)

Year	Cuyuna	Mesabi	Vermilion	Spring Valley district	Total
1953–57 (average)	2,286	61,958	1,421	276	65,940
1958	1,119	39,833	1,027	241	42,221
1959	745	33,747	809	576	35,877
1960	1,166	54,442	1,361	473	57,442
1961	1,095	41,199	930	491	43,714
1962	655	43,041	1,158	362	45,216

[1] Exclusive of iron ore containing 5 percent or more manganese.

TABLE 4.—Crude iron ore [1] data, in 1962, by counties and ranges

(Thousand long tons)

County and range	Stocks Jan. 1	Production		Shipments		Stocks Dec. 31
		Underground	Open pit	Direct to consumers	To beneficiation plants	
County:						
Crow Wing	42	259	705	426	553	27
Fillmore [2]			681		681	
Itasca	19		26,032	174	25,877	
St. Louis	836	1,353	68,158	10,866	58,618	863
Total [3]	898	1,611	95,576	11,466	85,729	890
Range:						
Cuyuna	42	259	705	426	553	27
Mesabi	778	98	94,190	10,717	83,525	824
Vermilion	78	1,254		323	970	39
Spring Valley district			681		681	
Total	898	1,611	95,576	11,466	85,729	890

[1] Exclusive of ore containing 5 percent or more manganese.
[2] Includes ore from three properties in Olmsted County.
[3] Data do not add to totals shown due to rounding.

TABLE 5.—Usable iron ore [1] data, in 1962, by counties and ranges

(Thousand long tons)

County and range	Stocks Jan. 1	Production	Iron content of production	Shipments	Stocks Dec. 31
County:					
Crow Wing	115	655	325	684	85
Fillmore [2]		362	172	356	7
Itasca	956	10,005	5,532	9,827	1,134
St. Louis	2,990	34,194	19,213	33,428	3,756
Total	4,061	45,216	25,242	44,295	4,982
Range:					
Cuyuna	115	655	325	684	85
Mesabi	3,743	43,041	24,046	42,162	4,622
Vermilion	203	1,158	699	1,093	268
Spring Valley district		362	172	356	7
Total	4,061	45,216	25,242	44,295	4,982

[1] Exclusive of ore containing 5 percent or more manganese.
[2] Includes ore from three properties in Olmsted County.

TABLE 6.—Iron ore [1] shipped from Minnesota mines

(Thousand long tons)

Year	Crude ore to concentrators	Beneficiated			Total usable ore [2]	Proportion of beneficiated to total usable ore (percent)
		Agglomerates	Other	Total		
1953–57 (average)	53,398	3,271	22,486	25,757	65,772	39.16
1958	55,224	8,829	14,460	23,289	42,502	54.79
1959	48,024	8,401	11,513	19,914	36,109	55.15
1960	88,060	11,489	21,693	33,181	54,723	60.63
1961	79,825	14,366	17,698	32,064	44,699	71.73
1962	85,729	14,085	18,744	32,829	44,295	74.11

[1] Exclusive of ore containing 5 percent or more manganese.
[2] Direct-shipping and beneficiated ore.

cationic flotation at its Hoyt Lakes plant. Oliver Iron Mining Division of the United States Steel Corp. continued to operate its Pilotac taconite mine and concentrator near Mountain Iron. The taconite concentrate was shipped by rail to the Oliver Extaca plant near Virginia for agglomeration.

Experimental research continued to determine commercial feasibility of using nonmagnetic semitaconite ores from the Minnesota iron ranges. The Hanna Mining Co. and the Oliver Iron Mining Division conducted experimental research at pilot plants near Cooley and Coleraine, respectively. Both plants used Lurgi kilns to convert the nonmagnetic iron minerals to artificial magnetite for subsequent processing by magnetic separation. W. S. Moore Co. and Northern Natural Gas Co. announced plans in November to build an experimental pilot plant to convert low-grade hematite ores into magnetite by reduction roasting. Final upgrading of the ores would be by conventional magnetic separation. The ARA sponsored R–N direct reduction tests, Krupp-Renn process tests, and a plant feasibility study. The ARA and IRRRC granted funds to W. S. Moore Co. to build an iron-ore-briquetting plant to study utilization of fine ores that are presently undesirable for blast furnace use.

Operations at many mines and plants were curtailed or suspended. Late in the year Oliver Iron Mining Division and Zenith Mining Co. closed their Soudan and Zenith underground mines, respectively, near Ely, on the Vermilion Range. The first shipment of Minnesota iron ore left the Soudan mine in 1884, and shipments from the mine have been made every year since. Only three underground mines—one each on the Cuyuna, Mesabi, and Vermilion Ranges—remained in production. Cleveland-Cliffs Iron Co. closed the Hawkins open-pit mine near Nashwauk. Pittsburgh Pacific Co. canceled its lease on the West Airport mine, Cuyuna Range, and ceased operations at its Meadow and Mary Ellen properties on the eastern Mesabi Range. The company erected a crushing and screening plant to serve the Albany underground mine near Hibbing. In 1962 Wilson Marine Transit Co. acquired a substantial interest in Pittsburgh Pacific Co. The latter company sold its subsidiary, Coons Pacific Co., to a group consisting of Common Interests, Inc., and former officers of Coons Pacific Co. The Hanna Mining Co. relinquished its lease on the Carlz No. 1 Reserve near Keewatin. Oliver Iron Mining Division announced plans to cancel its lease on the Agnew No. 3 Reserve, held since 1904. Jones & Laughlin Steel Corp. increased the capacity of the Hill Annex Reclamation Plant, installed additional spirals at its Schley concentrator, and added heavy density and jigging sections to the Lind-Greenway concentrator.

The Federal Bureau of Mines continues research on the beneficiation of nonmagnetic taconites and semitaconites at its Minneapolis Research Center. Two reports on the further evaluation of Mesabi nonmagnetic taconites from the West Central Mesabi Range were published.[3] [4]

[3] Wasson, P. A., D. W. Frommer, L. F. Heising, R. E. Lubker, and R. L. Blake. Lake Superior Iron Resources. Metallurgical Evaluation and Classification of Nonmagnetic Taconite Drill Cores from the West Central Mesabi Range. BuMines Rept. of Inv. 6081, 1962. 62 pp.

[4] Frommer, D. W., and P. A. Wasson. Lake Superior Iron Resources. Further Metallurgical Evaluation of Mesabi Range Nonmagnetic Taconites (Reduction Roasting and Magnetic Separation). BuMines Rept. of Inv. 6104, 1962, 47 pp.

Metallized pellets from taconite were successfully prepared on a continuous basis in a 3-foot by 36-foot rotary kiln using lignite as the reductant.[5]

The 1962 navigation season for ports shipping Minnesota ores opened on April 17 at Taconite Harbor and closed on December 13 at the same port.

Effective April 1, 1962, Lake Erie base prices for standard Mesabi and Old Range ores were reduced 80 cents per ton, the first reduction since 1940. The following Lake Erie base prices were in effect for the 1962 season: Mesabi nonbessemer and high phosphorous, regular, $10.65 per ton (coarse, $11.45 and fines, $10.20); Mesabi bessemer, $10.80; Old Range nonbessemer, $10.90; and Old Range bessemer, $11.05. In addition, Oliver Iron Mining Division had the following price schedule for special ores: Taconite concentrate sinter, $12.85 per ton; taconite concentrate open-hearth nodules, $13.25 per ton; and open-hearth lump ore, $13.25 per ton. All the foregoing prices were for ore delivered at rail of vessel at lower Lake ports and were based on a natural iron content of 51.50 percent. Premiums and penalties were applied for variations in analyses and physical structure. Average weighted mine value for Minnesota iron ores was $8.71 per ton, compared with $9.11 in 1961. The decrease was primarily attributable to reduced iron ore prices.

Manganiferous Ore.—Manganiferous ore shipments (containing 5 to 35 percent manganese, natural) were 61 percent more than in 1961. Chief reason for the increase was the re-entry of the Sultana-Hopkins mine to the shipping rolls. Total shipments were 261,410 long tons, consisting of 86,737 tons of direct-shipping grade and 174,673 tons of concentrates. Output was divided nearly equal between ferruginous manganese ore (containing 10 to 35 percent manganese, natural) and manganiferous iron ore (containing 5 to 10 percent manganese, natural). All shipments were from newly mined ore except about 11,000 tons shipped from stockpile. Approximately 86 percent of the 619,000 long tons of crude ore mined was beneficiated. Average natural iron

TABLE 7.—Shipments of usable[1] manganiferous iron ore and ferruginous manganese ore from mines in the Cuyuna Range

(Long tons)

Year	Manganiferous iron ore (5 to 10 percent Mn, natural)			Ferruginous manganese ore (10 to 35 percent Mn, natural)			Total shipments
	Shipments	Contents (natural)		Shipments	Contents (natural)		
		Fe, percent	Mn, percent		Fe, percent	Mn, percent	
1953–57 (average)	565,626	38.99	5.98	110,515	33.50	12.07	676,141
1958	285,995	41.47	6.22	44,901	34.51	13.14	330,896
1959	273,541	39.35	6.42	109,586	34.34	11.76	383,127
1960	345,426	38.97	7.15	48,349	34.37	12.74	393,775
1961	80,603	32.05	9.01	81,750	35.58	12.29	162,353
1962	129,979	40.40	6.19	131,431	33.28	12.60	261,410

[1] Direct-shipping and beneficiated ore.

[5] Melcher, Norwood B. Smelting Prereduced Iron Ore Pellets—What Could This Technique Mean to Commercial Blast-Furnace Operation? J. Metals. V. 15, No. 4, April 1963, pp. 298–301.

and manganese contents of the ores were 36.82 and 9.42 percent, respectively.

Manganiferous ores were shipped from five Cuyuna Range mines, all in Crow Wing County. Producing companies were The Hanna Mining Co., and the Pittsburgh Pacific Co. The Pittsburgh Pacific Co. mined ore from the Sultana-Hopkins mine (which had been idle for several years) under contract from Pickands Mather & Co., agent. Ore reserves from the Mahnomen mine were exhausted during the season. Approximately 12 million tons have been produced from this mine since shipments began in 1916. Manganese Chemicals Corp. closed its Riverton plant, at which manganese compounds had been produced from low-grade manganiferous materials since 1953.

Total value of the manganiferous ore shipped increased 61 percent. Iron ore containg more than 5 percent manganese, natural, has generally been priced as Old Range nonbessemer because of the combined natural iron and manganese content, with an added premium for natural manganese content exceeding 5 percent.

NONMETALS

Abrasive Stones.—Jasper Stone Co. produced grinding pebbles and tube-mill liners from its quartzite deposit near Jasper in Rock County. Sales of both products were more than in 1961. The company also sold some broken material for riprap.

Cement.—Universal Atlas Cement Division of United States Steel Corp. produced portland and masonry cements at its Duluth plant, the only cement plant in the State. Shipments of portland and masonry cements decreased from 1961 because of lesser demand for building construction. However, sales of portland cement for highway construction increased substantially. Portland-cement output consisted primarily of types I and II (general-use and moderate-heat), and portland-slag cement. A small quantity of type III (high-early strength) was also shipped. Raw materials used in manufacturing portland cement included limestone, gypsum, blast-furnace slag, sand, iron dust, and small quantities of air-entraining compounds and grinding aids. The plant had one 200-foot and two 150-foot kilns.

Clays.—Total production of fire clay and miscellaneous clay was less than in 1961. A drop in output of clays for manufacturing heavy clay products offset a gain in production for lightweight aggregate.

Clay was produced in Brown, Carlton, Goodhue, Hennepin, Ramsey, and Redwood Counties. The material was used for manufacturing lightweight aggregate, building brick, vitrified sewer pipe, floor and wall tile, and other products.

Red Wing Potteries, Inc., continued to produce dinnerware and art pottery in Red Wing, chiefly from raw materials produced in other States.

International Minerals & Chemical Corp. acquired options on clay properties near Redwood Falls, in Redwood County.

The Iron Range Resources and Rehabilitation Commission drilled a clay deposit near Cook, in St. Louis County, primarily to determine whether a ceramics plant would be feasible in the area.

Gem Stones.—Semiprecious gem stones, principally agates, were collected by hobbyists along the north shore of Lake Superior, along the

Mississippi River, and in gravel pits in the southeastern part of the State. Gem materials collected in the State were used primarily for personal collections and handmade jewelry.

Lime.—Total production of quicklime and hydrated lime decreased from 1961, principally because of the decline in output for use in sugar refining. Captive quicklime was produced by American Crystal Sugar Co. at Chaska, Crookston, East Grand Forks, and Moorhead.

The sole commercial producer of lime in the State was Cutler-Magner Co., who produced quicklime and hydrated lime at a plant in Duluth. Company output was slightly above that of 1961. Sales were primarily for chemical and industrial uses, including paper manufacture, water treatment, and metallurgical purposes. Lesser quantities were sold for construction and agricultural uses. Shipments were chiefly to consumers in Minnesota and neighboring States.

Perlite.—Perlite-processing plants were operated in Minneapolis by Minnesota Perlite Corp. and Western Mineral Products Co. The crude material processed was mined in Nevada and New Mexico. Sales of expanded perlite decreased substantially from 1961. The expanded product was sold for lightweight aggregate in plaster and concrete, soil conditioning, and other uses.

Sand and Gravel.—Production of sand and gravel decreased 4 percent in quantity and 6 percent in total value, compared with 1961. Chief reason for the decline was the 1.4-million-ton drop in output for paving use, which more than offset increases in production for other uses. Inclement weather adversely affected road construction in certain areas. The quantity of sand and gravel for building use was 2 percent more than in 1961. Output for railroad ballast also increased. Total production of industrial sands decreased from 1961, although certain special uses recorded increases.

Approximately 70 percent of the total quantity produced was for paving, 22 percent for building use, 4 percent for fill, and 2 percent for railroad ballast. Smaller, but important, quantities of special sands were used for manufacturing glass, grinding and polishing, sandblasting, oilfield fracturing, engine use, filler, and foundry applications. Commercial operations furnished 65 percent of the total production, and Government-and-contractor operations supplied the remainder. About 92 percent of the total output was shipped by truck, 5 percent by rail, and 3 percent by river barge.

Production was reported from every county except Waseca. Major producing counties were Clay, Dakota, Hennepin, Le Sueur, Polk, Ramsey, St. Louis, and Washington, which together furnished 36 percent of the total tonnage and 45 percent of the total value of production.

Stone.—Combined output of basalt, granite, limestone, marl, and quartzite decreased 4 percent in quantity but increased 4 percent in total value, compared with 1961. Lesser demand for crushed limestone for road construction was the chief reason for the drop in quantity. The gain in total value was attributed primarily to increased sales of dimension stone for architectural purposes.

Limestone was quarried from deposits in 16 south-central and southeastern counties. Total output of dimension and crushed limestone decreased 7 percent in quantity, but the total value remained about the same. Quantity of crushed limestone for concrete aggregate and roadstone decreased 9 percent from 1961. Sales of agricultural lime-

TABLE 8.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,596	$3,011	3,800	$2,941
Paving	3,021	1,996	1,824	1,350
Railroad ballast	17	11	(1)	(1)
Fill	388	221	408	265
Grinding and polishing	1	1	(1)	(1)
Molding	(1)	(1)	60	219
Undistributed [2]	314	835	232	631
Total	7,337	6,075	[3] 6,325	[3] 5,407
Gravel:				
Building	2,805	4,171	2,807	4,089
Paving	8,031	6,747	9,062	6,683
Railroad ballast	371	329	489	297
Fill	397	195	294	151
Other	168	127	113	74
Total	11,772	11,569	12,765	11,294
Total sand and gravel	19.109	17,644	19.090	16,701
Government-and-contractor operations:				
Sand:				
Paving	3,792	1,986	2,616	1,407
Fill	101	32	83	28
Other			57	21
Total	3,893	2.018	2,756	[3] 1.455
Gravel:				
Building	63	35	3	2
Paving	7,273	4,330	7,177	4,364
Fill	346	115	341	118
Other	6	1	32	16
Total	7,688	4,481	7,553	4.500
Total sand and gravel	11.581	6.499	10,309	5,955
All operations:				
Sand	11,230	8,093	9,081	6,862
Gravel	19.460	16.050	20,318	15.794
Grand total	30,690	24,143	29,399	22,656

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes glass, engine, filler, blast, oil (hydrafrac), foundry uses, other sand, and items indicated by footnote 1.
[3] Data do not add to totals shown due to rounding.

stone declined 4 percent by tonnage. Virtually all other uses of crushed limestone registered gains over the previous year. Output of dimension limestone decreased in quantity because of the marked drop in sales for house stone veneer. However, total value of dimension limestone increased because of the substantial gain in sales of cut stone for architectural purposes.

Granite was quarried in central Minnesota (in Kanabec, Mille Lacs, and Stearns Counties) and in the upper Minnesota River Valley (in Big Stone, Lac qui Parle, Redwood, Renville, and Yellow Medicine Counties). The quarry of Mesaba Granite Co. in St. Louis County was inactive throughout 1962. Most of the dimension granite was processed at finishing plants in Cold Spring, Delano, and St. Cloud. Sales of dressed granite for architectural purposes and monuments

TABLE 9.—Granite sold or used by producers, by uses

Use	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Dimension:				
Rough construction, thousand short tons	13	$14		
Rough architectural, thousand cubic feet	34	106	(1)	(1)
Rough monumental, do	(1)	(1)	(1)	(1)
Dressed architectural, do	(1)	(1)	(1)	(1)
Dressed monumental, do	(1)	(1)	105	$1,107
Undistributed, do	306	2,970	199	2,397
Total, approximate thousand short tons [2]	41	3,090	25	3,504
Crushed and broken:				
Riprap, thousand short tons	(3)	(3)	2	3
Concrete aggregate and roadstone, do	102	197	96	175
Railroad ballast [4], do	[5] 232	378	354	466
Stone sand, do			1	1
Total, do	334	575	453	645
Grand total [6], do	376	3,665	478	4,149

[1] Figure withheld to avoid disclosing individual company confidential data; included with Undistributed.
[2] Average weight of 166 pounds per cubic foot used to convert cubic feet to short tons.
[3] Less than 500.
[4] Includes poultry grit to avoid disclosing individual company confidential data.
[5] Revised figure.
[6] Data do not add to totals shown due to rounding.

TABLE 10.—Limestone sold or used by producers, by uses

Use	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Dimension:				
Rough construction and rubble, thousand short tons	6	$25	(1)	(1)
Rough architectural, thousand cubic feet	16	46	11	$40
Sawed, do	22	94	24	118
Cut, do	107	1,038	140	1,518
House stone veneer, do	206	535	132	323
Flagging, do	5	3	(1)	(1)
Total, approximate thousand short tons [2]	34	1,741	27	2,023
Crushed and broken:				
Riprap, thousand short tons	29	27	70	92
Concrete aggregate and roadstone, do	2,993	3,492	2,726	3,064
Agriculture, do	384	579	367	571
Asphalt, do	44	246	52	289
Other [3], do	2	7	11	30
Total, do	3,452	4,351	3,226	[4] 4,045
Grand total, do	3,486	6,092	[4] 3,254	6,008

[1] Figure withheld to avoid disclosing individual company confidential data; included in total.
[2] Average weight of 160 pounds per cubic foot used to convert cubic feet to short tons.
[3] Includes poultry grit (1961), flux, mineral food, and other uses.
[4] Data do not add to totals shown due to rounding.

were more than in 1961. Production of crushed granite increased 36 percent in quantity because of the substantial gain in output for railroad ballast. However, crushed granite for road use decreased from 1961.

Quartzite production decreased about one-third from 1961. Output was from quarries in Nicollet and Rock Counties. Sales were chiefly

for concrete aggregate and roadstone. Some material was sold for poultry grit, refractory purposes, and riprap. Nearly three-fourths of the total shipments were by truck; the remainder, by rail.

Crushed basalt for concrete aggregate and roadstone was produced by Zenith Dredge Co. in St. Louis County. Output decreased from 1961.

Production of calcareous marl decreased slightly in quantity from 1961. Two companies reported production from pits in Cass and Wadena Counties. The entire output was sold for agricultural purposes.

Sulfur.—Great Northern Oil Co. recovered byproduct sulfur at its Pine Bend refinery in Dakota County. Shipments decreased from 1961. Plans were announced to increase the refinery capacity about 10 percent by early 1963.

Vermiculite.—Vermiculite was exfoliated at plants in Minneapolis and St. Paul from crude material mined in Montana. Sales of the exfoliated product increased 3 percent in quantity and 5 percent in total value over 1961. The material was sold for insulation, lightweight aggregate in plaster and concrete, litter, fire proofing, and acoustical purposes.

MINERAL FUELS

Peat.—A new record in peat production was established in 1962. Output of 12,934 tons was 17 percent greater than in 1961. Production was reported by seven companies, producing from bogs in Aitkin, Beltrami, Carlton, Itasca, Pine, and St. Louis Counties. Moss peat was the predominant type of peat produced during the year. Some reed-sedge peat and humus were also produced. Minnesota peat was sold mostly for soil improvement. Peat was sold in bulk and in polyethylene bags ranging in size from 1 quart to 6 cubic feet. The University of Minnesota continued research toward development of methods for utilizing the vast resource of peat in the State, estimated to be 7 billion tons.

REVIEW BY COUNTIES

Mineral production was reported from all counties in the State except Waseca. With its predominance of iron-ore mines, St. Louis County ranked first in value of minerals produced, furnishing 72 percent of the State total. Mineral output of 11 counties exceeded $1 million. Value of mineral production increased for 45 counties and decreased for 41. Marked decreases for Crow Wing, Fillmore, Itasca, and St. Louis Counties were attributable to the reduction in prices for standard iron ores. Virtually all the gains or decreases in other counties resulted from demand for road-construction materials. Sand and gravel production was common to all mineral-producing counties. Some counties are not included in the text of the County Review section. However, all counties having production in 1962 and the minerals produced are listed in table 11. Value of the sand and gravel and stone production, which could not be credited to a county source, is included under "Undistributed" in table 11.

Aitkin.—Sand and gravel for road building was produced in portable plants by the Minnesota Highway Department and Jay W. Craig Co. Kimball & Sons Co. produced moss peat near Hill City for horticulture.

TABLE 11.—Value of mineral production in Minnesota, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value
Aitkin	$183,446	(2)	Sand and gravel, peat.
Anoka	(2)	(2)	Sand and gravel.
Becker	380,990	(2)	Do.
Beltrami	(2)	(2)	Sand and gravel, peat.
Benton	95,681	$213,158	Sand and gravel.
Big Stone	(2)	347,153	Stone, sand and gravel.
Blue Earth	1,381,005	1,394,924	Do.
Brown	266,514	241,632	Sand and gravel, clays.
Carlton	347,917	416,358	Peat, sand and gravel, clays.
Carver	312,652	229,193	Sand and gravel, lime.
Cass	57,712	123,039	Sand and gravel, stone.
Chippewa	194,634	199,991	Sand and gravel.
Chisago	173,498	122,349	Do.
Clay	1,202,720	1,019,576	Sand and gravel, lime.
Clearwater	2,763	7,671	Sand and gravel.
Cook	136,218	121,011	Do.
Cottonwood	70,181	257,601	Do.
Crow Wing	9,816,038	6,396,197	Iron ore, manganiferous ore, sand and gravel.
Dakota	1,481,194	1,623,304	Sand and gravel, stone.
Dodge	132,635	(2)	Stone, sand and gravel.
Douglas	72,715	82,378	Sand and gravel.
Faribault	292,352	202,943	Do.
Fillmore	4,130,644	2,521,795	Iron ore, stone, sand and gravel.
Freeborn	406,043	309,934	Sand and gravel.
Goodhue	309,706	359,943	Stone, sand and gravel, clays.
Grant	(2)	167,849	Sand and gravel.
Hennepin	3,320,939	3,600,607	Sand and gravel, clays.
Houston	(2)	(2)	Stone, sand and gravel.
Hubbard	44,749	87,430	Sand and gravel.
Isanti	97,732	(2)	Do.
Itasca	83,098,533	76,531,060	Iron ore, sand and gravel, peat.
Jackson	120,628	169,313	Sand and gravel.
Kanabec	(2)	(2)	Sand and gravel, stone.
Kandiyohi	298,400	342,498	Sand and gravel.
Kittson	12,547	162,198	Do.
Koochiching	(2)	7,180	Do.
Lac qui Parle	558,291	466,793	Stone, sand and gravel.
Lake	38,844	59,191	Sand and gravel.
Lake of the Woods	52,280	99,585	Do.
Le Sueur	1,727,513	1,762,495	Sand and gravel, stone.
Lincoln	69,939	95,141	Do.
Lyon	230,085	144,088	Sand and gravel.
Mahnomen	407,991	(2)	Do.
Marshall	145,673	224,490	Do.
Martin	170,782	249,234	Do.
McLeod	274,790	156,254	Do.
Meeker	(2)	(2)	Do.
Mille Lacs	(2)	(2)	Stone, sand and gravel.
Morrison	(2)	(2)	Sand and gravel.
Mower	634,505	730,024	Stone, sand and gravel.
Murray	277	105,417	Sand and gravel.
Nicollet	289,801	282,376	Sand and gravel, stone.
Nobles	251,074	179,645	Sand and gravel.
Norman	127	(2)	Do.
Olmsted	255,441	541,688	Sand and gravel, iron ore.
Otter Tail	404,916	272,714	Sand and gravel.
Pennington	72,956	71,494	Do.
Pine	(2)	49,224	Sand and gravel, peat.
Pipestone	(2)	239,433	Sand and gravel.
Polk	1,278,276	927,318	Sand and gravel, lime.
Pope	198,592	81,761	Sand and gravel.
Ramsey	795,865	747,594	Sand and gravel, clays, stone.
Red Lake	1,469	(2)	Sand and gravel.
Redwood	89,736	100,974	Sand and gravel, stone, clays.
Renville	513,440	339,393	Sand and gravel, stone.
Rice	343,880	270,562	Do.
Rock	475,872	478,999	Sand and gravel, abrasives, stone.
Roseau	146,497	193,192	Sand and gravel.
St. Louis	[3] 320,715,658	310,465,606	Iron ore, cement, sand and gravel, lime, stone, peat
Scott	870,002	903,003	Stone, sand and gravel.
Sherburne	133,570	(2)	Sand and gravel.
Sibley	117,438	453,483	Do.
Stearns	2,544,802	2,790,357	Stone, sand and gravel.
Steele	369,899	296,606	Sand and gravel, stone.
Stevens	80,346	(2)	Sand and gravel.
Swift	261,723	147,447	Do.
Todd	240,930	114,544	Do.
Traverse	1,301	(2)	Do.
Wabasha	184,061	273,229	Sand and gravel, stone.
Wadena	5,564	25,470	Do.
Washington	2,085,917	1,975,775	Do.

See footnotes at end of table.

TABLE 11.—Value of mineral production in Minnesota, by counties[1]—Continued

County	1961	1962	Minerals produced in 1962 in order of value
Watonwan	$90,183	$53,217	Sand and gravel.
Wilkin	(2)	21,438	Do.
Winona	808,589	854,561	Stone, sand and gravel.
Wright	218,886	239,736	Sand and gravel.
Yellow Medicine	252,375	423,927	Stone, sand and gravel.
Undistributed[4]	4,063,307	3,769,404	
Total	[3] 450,914,000	428,936,000	

[1] No production reported for Waseca County.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.
[4] Includes some sand and gravel and stone that cannot be assigned to specific counties and values indicated by footnote 2.

Anoka.—Molding and foundry sands were produced by Minnesota Silica Sand Co. at its plant near Anoka. Paving gravel was produced by Megarry Bros. and the county highway department.

Becker.—The Becker County Sand & Gravel Co. produced material for paving and building, railroad ballast, fill, and engine use. The State and county highway departments produced sand and gravel for road construction.

Beltrami.—Sand and gravel was produced and contracted for by the State and county highway departments primarily for road use. The Minnesota Peat Co. produced moss and humus peat from a plant near Kelliher. The peat was sold in package form for horticultural uses.

Benton.—About 395,000 tons of sand and gravel was produced in the county. Henry S. Sakry Co. and Megarry Bros. operated portable plants and produced paving gravel. The State and county highway departments produced and contracted for road material.

Big Stone.—Delano Granite Works, Inc., quarried granite near Odessa. Cold Spring Granite Co. made stockpile shipments of granite from its agate quarry. The rough material was finished for monumental and architectural purposes at company finishing plants in Delano and Cold Spring. Hallett Construction Co. produced sand and gravel from stockpiles near Odessa for road paving. State and county highway departments produced and contracted for road material.

Blue Earth.—Mankato Stone Co. and Vetter Stone Co. produced dimension limestone at Mankato, principally for architectural use. Lundin Construction Co. and Mankato Aglime & Rock Co. produced crushed and broken limestone near Mankato for road construction, agricultural use, and riprap. Sand and gravel for building and road construction was produced by Guaranteed Gravel & Sand Co., Hiniker Sand & Gravel Co., and North Star Concrete Co. from pits near Mankato.

Brown.—Ochs Brick & Tile Co. produced shale from a pit near Springfield. The output was used chiefly for producing building brick and lightweight aggregate. About 234,000 tons of sand and gravel was produced for building, road construction, fill, and other uses. Portable plants were operated by Roberts Bros. near Sleepy Eye and by Hallett Construction Co. near Springfield. Fixed plants were operated by Math. N. Schumacher; Wallner Construction Co., Inc.; and M. M. Youngman near Springfield, New Ulm, and Sleepy Eye, respectively. The State and county highway departments produced and/or contracted for paving sand and gravel.

Carlton.—Clay was produced by the Nemadji Tile & Pottery Co. for use in manufacturing floor tile. Sand and gravel for building, road construction, railroad ballast, and fill was produced by four companies operating pits near Cloquet, Carlton, and Moose Lake. Road material was produced or contracted for by the State and county highway departments and the city of Cloquet.

Red Wing Peat Co. produced sphagnum peat at its large-scale operation near Cromwell. The material was processed and dried in an oil-fired rotary kiln and marketed mostly in 6-cubic-foot polyethylene bags.

Carver.—American Crystal Sugar Co. produced quicklime at Chaska and used the entire output for manufacturing sugar.

Sand and gravel was produced by Wm. Mueller & Sons, Rosenwinkel Sand & Gravel Co., and Ahles & Lush. The material was used for road construction and building.

Cass.—Sand and gravel was produced by the Northern Pacific Railway Co. and Megarry Bros. Output was for railroad ballast and road construction. The State and county highway departments produced and contracted for sand and gravel, chiefly for road building. Sorum's Marl Service produced marl for agricultural purposes near Remer.

Clay.—American Crystal Sugar Co. produced quicklime for sugar refining at Moorhead. Sand and gravel was produced by seven companies and the State highway department for building and road construction and fill. The county highway department contracted for paving gravel.

Cook.—Erie Mining Co. shipped 7.7 million tons of taconite concentrate, produced in St. Louis County, from Taconite Harbor. This record shipment was the largest since the harbor opened in 1957. The first cargo of the 1962 shipping season was loaded April 17, and the final cargo left Taconite Harbor December 13.

Sand and gravel for building and road construction was produced by Ogema Land & Abstract Co. and Edwin E. Thoreson, Inc., at fixed plants near Grand Marais. Megarry Bros. operated a portable plant and produced paving gravel. The State highway department produced and contracted for paving sand and gravel. The county highway department contracted for gravel for fill. Total sand and gravel produced in the county was 210,000 tons, a 12-percent reduction from 1961.

Crow Wing.—Total shipments of manganiferous and ferruginous manganese ores increased 61 percent above 1961. Chief reason for the increase was the return to shipping of the Sultana-Hopkins mine, which had been idle for a few years. Iron-ore shipments decreased 41 percent in 1962. Operating companies and mines from which iron and/or manganiferous ores were shipped were as follows:

Company:	*Mines*
The Hanna Mining Co	Mahnomen and Robert.
Inland Steel Co	Armour No. 2.
Pittsburgh Pacific Co	Sagamore, Mangan No. 1, Manuel, Mangan-Joan, and West Airport.
Pickands Mather & Co., operated by Pittsburgh Pacific Co.	Sultana-Hopkins.

All mines operated in the county during the year were open pits with the exception of the Armour No. 2 underground mine. About 54 percent of the total iron and manganiferous ores shipped was direct-shipping grade, the remainder was concentrate. The Mahnomen mine, acquired by Hanna from Pickands Mather & Co. in 1961, was exhausted during the season. Hanna also shipped from stocks of Robert mine concentrates; its Huntington mine was idle throughout the year. Inland Steel operated the Armour No. 2 underground mine at a reduced work schedule. Pickands Mather & Co. did not operate its Cuyuna properties during the year. Pittsburgh Pacific Co. operated the Sultana-Hopkins mine under contract from Pickands Mather & Co. Pittsburgh Pacific canceled its Manuel and West Airport leases but shipped concentrates from stocks at these properties. Early in the year, Manganese Chemicals Corp. closed its Riverton plant, which had produced manganese compounds from low-grade manganiferous ores since 1953. Rhude & Fryberger, after 16 years of operations, surrendered the lease on the Pennington mine.

Ripley Sand & Gravel, Inc., and Les Roberts Sand, Gravel & Excavating Co. operated fixed sand and gravel plants near Brainerd and produced material for building and road construction and other purposes. The State and county highway departments produced and contracted for paving sand and gravel.

Dakota.—Sand and gravel was produced by eight companies. Production in 1962 increased 41 percent to 1,647,000 tons, primarily because of increased highway construction. The sand and gravel produced was used for building, road construction, and other uses. Operating fixed plants were Edward Kraemer & Sons, Inc.; Northwestern Gravel Co., Inc.; Swanson Aggregate, Inc.; and Standard Building Material Co. Portable plants were operated by Bituminous Surface Treating Co., B. P. Cords, Jay W. Craig Co., and Kimmes Bartelma Construction Co. The road construction material requirements of the State and county highway departments were received under contract.

Crushed limestone for roadstone and agricultural use was produced by Edward Kraemer & Sons, Inc., from its Burnsville quarry. The Northwestern Gravel Co., Inc., discontinued its quarry operation near Savage. The Great Northern Oil Co. awarded a contract for enlarging its Pine Bend refinery near St. Paul. The project, when complete in early 1963, will increase capacity 10 percent. The company produces byproduct elemental sulfur.

Northwest Cooperative Mills, Inc., completed construction of a 100,000-ton-capacity phosphate fertilizer plant at Pine Bend.

Fillmore.—Shipments of iron ore from Fillmore County mines were 320,000 long tons. Virtually the entire output was shipped by rail to consuming furnaces at Granite City, Ill. The Hanna Mining Co. shipped 310,000 tons of iron ore concentrate from its Spring Valley group of mines. Schroeder Mining Co. shipped from the Plenge and Anderson properties and installed a new classifier at its beneficiation plant.

Crushed limestone was produced by five companies for road construction and agricultural use. Portable plants were operated by Hadland & Vreeman (68,000 tons) near Ostrander; Hector Construction Co., Inc., near Lanesboro; Kappers Construction Co. (84,000 tons) at Fountain; and Quarve & Anderson Co. Pederson Brothers operated a

fixed plant at Harmony. Bothun & Torgerson Sand & Gravel Co. and Hector Construction Co., Inc., produced sand and gravel near Lanesboro. The material was for building and road construction, fill, and other purposes. The State highway department produced 8,000 tons of paving sand and gravel.

Goodhue.—Red Wing Sewer Pipe Corp. produced plastic fire clay at the Thomforde and Goodhue pits for use chiefly in manufacturing vitrified sewer pipe. Mann Construction Co. produced crushed and broken limestone from five quarries for road construction, agricultural lime, and riprap. Valley Limestone Co. produced limestone for road and agricultural uses and riprap from a quarry near Zumbrota. Kielmeyer Construction Co. and Quarve & Anderson Co. produced crushed limestone for roadstone. Sand and gravel was produced by seven companies for building, road construction, and fill. Pits were operated near Frontenac, Lake City, Red Wing, and Zumbrota. The State and county highway departments produced and/or contracted for paving sand and gravel.

Hennepin.—About 3.7 million tons of sand and gravel were produced, chiefly in Minneapolis suburban areas. Output was for road construction, building, fill, molding sand, and other uses. The major tonnage was produced in fixed plants. Commercial operators included Craig J. Alexander; Anderson Aggregates, Inc.; Barton Contracting Co.; Concrete Service, Inc.; Consolidated Materials Co.; Chas. M. Freidheim Co.; Frisk Sand Co.; Glacier Sand & Gravel Co.; J. V. Gleason; Hedberg & Sons Co.; Hopkins Sand & Gravel Co.; Industrial Aggregate Co.; Keller Bros. Gravel Co.; Kimmes Bartelma Construction Co., Inc.; Landers-Norblom-Christenson Co.; Mapco Sand & Gravel Co.; Megarry Bros.; and Oscar Roberts Co. The State and county highway departments produced and/or contracted for paving sand and gravel.

Clay was produced near Minneapolis by North Central Lightweight Aggregate Co., Inc., and was used in making lightweight aggregate by sintering.

Minnesota Perlite Corp. and Western Mineral Products Co. expanded perlite at plants in Minneapolis from material mined in Nevada and New Mexico. Output was sold for soil conditioning, insulation, paint texture additive, and as lightweight aggregate in concrete and plaster. Exfoliated vermiculite was produced by B. F. Nelson Manufacturing Co. and Western Mineral Products Co. from crude vermiculite mined in Montana. The exfoliated vermiculite product was used for lightweight aggregate in plaster and concrete, loose fill insulation, and for acoustical and miscellaneous uses.

Houston.—Hector Construction Co., Inc., operated a portable plant and produced crushed limestone for roadstone and agricultural use as well as paving sand. Botcher Construction Co. operated a portable plant near Houston and produced limestone for agricultural use, roadstone, and riprap. The State and county highway departments produced sand and gravel chiefly for road use.

Itasca.—Total value of Itasca County mineral output decreased 8 percent, chiefly because of reduction in iron-ore prices. Mining operations continued to be adversely affected by the low demand for conventional ores. Winter layoffs of operating personnel were more extensive than in previous years.

About 98 percent of the usable iron-ore shipments was concentrate. All mines operated in 1962 were open pits. Operating companies and mines from which iron ore was shipped were as follows:

Company:	*Mines*
Cleveland-Cliffs Iron Co	Canisteo, Hawkins, Hill-Trumbull, Holman-Cliffs, Sally, and Sargent.
The Hanna Mining Co	Hunner, Mississippi group, and Patrick group.
Jessie H. Mining Co	Jessie.
Jones & Laughlin Steel Corp	Hill Annex Mine, Hill Annex Tailings, Hill Annex Semi-Taconite, and Lind-Greenway.
Oliver Iron Mining Division, United States Steel Corp.	Arcturus group and Plummer.
Pickands Mather & Co	Bennett, Danube, and West Hill.

Jones & Laughlin Steel Corp. instrumented the cascade millfeed at its Hill Annex semitaconite plant and increased the flotation capacity of its Hill Annex reclamation plant, near Calumet, to 70 tons per hour. The company also added dense medium and jigging sections to its Lind-Greenway plant.

The Hanna Mining Co. and Oliver Iron Mining Division continued experimental research converting nonmagnetic semitaconite by reduction in kilns to artificial magnetite. Subsequent processing was by conventional methods as used by commercial taconite plants of the eastern Mesabi Range. Hanna closed its plant for 2 months for plant changes but resumed operation in September on a three-shift-per-day, 7-day-per-week schedule. The two plants are testing the technical and economic aspects of processing the low-grade nonmagnetic semitaconites found principally on the western Mesabi.

Cleveland-Cliffs closed the Hawkins mine near Nashwauk. Approximately 25 million tons have been shipped from this mine since it began producing in 1902. Minor plant improvements were made at the Holman-Cliffs mill to improve concentrate grade and recovery of the dense medium used.

Pickands Mather & Co. resumed production at the Danube mine and added one dense medium section to the West Hill plant. The Argonne and Harrison groups of the Hanna Mining Co. were idle throughout the year.

Sand and gravel was produced near Grand Rapids by Neil Baker, operating a fixed plant, and Hawkinson Construction Co., operating a portable plant. Output was for building and road construction. The State and county highway departments produced paving sand and gravel.

Moss peat was produced near Wawina by the Colby Pioneer Peat Co. Sales were chiefly for soil conditioning.

Kanabec.—The Mora Gray quarry of Cold Spring Granite Co. was not operated in 1962. However, shipments of dimension granite for architectural use and monuments were made from stockpiles. The county highway department produced and contracted for paving gravel.

Lac qui Parle.—Cold Spring Granite Co. and the North Star Granite Corp. quarried granite near Odessa. The rough stone was shipped to finishing plants at Cold Spring and St. Cloud, respectively, and processed into architectural stone and monuments. The Dewar Bellingham Granite Co. and Dakota Granite Co. quarried granite near

Bellingham. The rough stone, after processing, was sold for monuments and mausoleums. Sand and gravel for building and road paving was produced by Johnson Road Co., Inc.; W. J. Stolpman; and Ahles & Lush. The State and county highway departments produced and contracted for 30,000 tons of sand and gravel for road paving and fill.

Lake.—Reserve Mining Co. processed approximately 18 million long tons of crude taconite at its Silver Bay plant. Approximately 5.6 million tons of taconite-concentrate pellets was shipped during the year. Work continued on the $120 million expansion program, which was expected to be completed in January 1963. Additional dumping, crushing, and magnetic concentrating facilities have been installed to increase plant capacity to 9 million tons of concentrate pellets. The first cargo of the year was loaded at Silver Bay on April 18. The final cargo of the season left the port on November 24.

Two Harbors Aggregate Co. produced sand and gravel at Two Harbors for building, road sanding, and fill. The State and county highway departments produced or contracted for 100,000 tons of sand and gravel for road construction.

Le Sueur.—The Babcock Co. produced dimension limestone near Kasota. Principal products were cut stone and stone veneer. A portion of the product was marketed as marble for interior trim and facings. Some of the material was sold for rough construction and riprap. Ed. Swartout operated a portable crushing plant near Kasota, producing crushed limestone and gravel for road use.

Silica sand was produced from the Jordan Sandstone formation near Le Sueur by Gopher State Silica, Inc., and sold for use in manufacturing glass, molding, oilfield fracturing, filler, and building. The Babcock Co. produced silica sand for grinding and polishing from a pit formerly operated by E. H. Benjamin. Glander Washed Sand & Gravel Co. produced sand and gravel near Gaylord for building and road construction. Craig J. Alexander, Kimmes Bartelma Construction Co., Inc., and Lundin Construction Co. operated portable sand and gravel plants, and Zarnott Construction Co. operated a fixed plant—producing material chiefly for road construction. The State highway department produced and contracted for paving sand and gravel.

Mille Lacs.—Dimension granite for architectural use and monuments was produced by Cold Spring Granite Co. from its Diamond Grey quarry near Isle. Final processing was done at its Cold Spring plant.

Mille Lacs Sand & Gravel Co. produced 17,000 tons of sand and gravel for building use and other purposes at a fixed plant near Milaca. Megarry Bros. operated a portable sand and gravel plant producing material for roads. The State and county highway departments produced and/or contracted for paving gravel.

Mower.—Martin Bustad & Son produced crushed limestone for roadstone and agricultural use at a fixed plant near Austin. Hickok Calcium White Rock Co. produced limestone near LeRoy for flux, mineral food, agricultural use, roadstone, and rubble. Osmundson Bros. and Quarve & Anderson Co. also produced limestone, chiefly for roadstone.

About 300,000 tons of sand and gravel was produced by six companies operating fixed and portable plants near Austin and Adams.

The material was used for building, roads, and other uses. The county highway department contracted for paving gravel.

Nicollet.—New Ulm Quartzite Quarries, Inc., produced crushed quartzite at a quarry near New Ulm. Output was sold chiefly for concrete aggregate, refractories, riprap, and other uses.

Sand and gravel was produced by three companies operating fixed plants near Courtland and St. Peter for building, paving, and other uses. The State and county highway departments contracted for paving sand and gravel.

Olmsted.—Schroeder Mining Co. produced iron ore from the Hinzman, Baker, Lowrie, Martin, and Partello properties. Most of the output was shipped by rail to consuming furnaces. Some ore was sold for use in manufacturing cement.

Sand and gravel for building, paving, and other uses was produced by four companies in the vicinity of Stewartville and Rochester. The State and county highway departments contracted for sand and gravel for paving.

Quarve & Anderson Co. produced crushed limestone for roadstone.

Otter Tail.—About 418,000 tons of sand and gravel was produced by five companies and the State highway department. Production was one-third less than in 1961. Principal use of the sand and gravel was in road construction.

Pine.—Value of mineral production dropped considerably because the interstate highway construction was completed. The State and county highway departments purchased or contracted for only one-tenth of their 1961 consumption of sand and gravel. Hallett Construction Co. shipped sand and gravel from stockpile. Louis Hultgren & Sons produced about 2,500 tons of molding sand near Kerrick. Yost Bros. produced sand and gravel at a fixed plant near Beroun and used the entire output for making ready-mixed concrete. Pine City Peat Co. produced reed-sedge peat 3 miles north of Pine City and sold the material in bulk and packaged form for soil conditioning.

Polk.—Mineral production decreased in value 27 percent, chiefly because of low production of sand and gravel. Commercial operators included the Great Northern Railway Co.; Northern Sand & Gravel, Inc.; Spring Gravel Co.; and Thorson Gravel Co. About 775,000 tons were produced for building, road construction, railroad ballast, fill, and other uses. The State and county highway departments produced paving sand and gravel. The county contracted for part of its needs.

American Crystal Sugar Co. produced quicklime at Crookston and East Grand Forks for use in sugar refining. Shaft kilns were utilized with coke as fuel.

Ramsey.—Arsenal Sand & Gravel Co. produced 628,000 tons of sand and gravel at its fixed plant near New Brighton. Craig J. Alexander and Jay W. Craig Co. operated portable plants. Cemstone Products Co. operated its St. Paul gravel pit. Output was used for building, road construction, fill, and other uses. The State highway department produced and contracted for paving sand and gravel.

Twin City Brick Co. produced miscellaneous clay for manufacturing building brick. Sebesta Stone Co. produced dimension limestone for flagging, riprap, and rough construction. The MacArthur Co. exfoliated vermiculite at its St. Paul plant from crude vermiculite mined

in Montana. The exfoliated product was used for building insulation and concrete and plaster aggregate.

Redwood.—Dimension granite for architectural and monumental uses was produced by Johnson Quarry Co. and View Quarry Co. from quarries near Belview. Miscellaneous clay was produced near Redwood Falls by Ochs Brick & Tile Co. and hauled to its Springfield brick plant for processing. Options on clay properties near Redwood Falls were acquired by International Minerals & Chemical Corp.

Sand and gravel production was 71,000 tons, 41 percent more than 1961. The increase was primarily due to increased road construction activity. Commercial operators included Buterbaugh Sand Co. and Chapman Gravel Co., operating fixed plants at Walnut Grove and Belview, respectively, and the Hallett Construction Co., Sanborn. Output was for building, paving, and fill. The State highway department produced 3,000 tons for paving. The Buterbaugh Sand Co. was sold to George Landwyd.

Renville.—Dimension granite was produced by Cold Spring Granite Co. at its Rainbow quarry and processed at its Cold Spring plant for architectural and monumental purposes. Its Melrose Tapestry quarry was idle.

About 290,000 tons of sand and gravel was produced. Commercial operators operating fixed plants were Danube Washed Sand & Gravel Co., Minnesota Sand & Gravel Co., and Morton Aggregates, Inc. Portagle plants were operated by Ahles & Lush and Fairview Construction Co. Plants were located at Danube, Belview, Morton, and Sacred Heart. Output was for building and road construction, fill, and other uses. The State and county highway departments produced and/or contracted for approximately 160,000 tons of paving sand and gravel.

Rice.—Approximately 71,000 tons of crushed and broken limestone for roadstone, agriculture, and riprap was produced at portable plants by Bryan Rock Products, Inc., Faribault Quarries, and Kielmeyer Construction Co. Quarries were near Northfield, Faribault, and Nerstrand.

About 319,000 tons of sand and gravel, 23 percent more than 1961, was produced by four commercial operators and the State highway department. The largest increase in use of sand and gravel was in road paving. Other uses included building and fill. The State and county highway departments contracted for paving sand and gravel.

Rock.—Grinding pebbles and tube-mill liners were produced by Jasper Stone Co. from a quartzite quarry near Jasper. Some broken stone was sold as riprap. About 470,000 tons of sand and gravel was produced, the same as in 1961. Producers were Hallett Construction Co.; C.H. Hatting Gravel Co., Inc.; and Pronk & Son, operating plants near Luverne and Leota, and the State highway department. Output was for building, road construction, fill, and other uses. The county highway department contracted for paving gravel.

St. Louis.—The value of St. Louis County mineral output decreased 3 percent in value, mainly because of the reduced prices for conventional iron ores, the continued low demand by the steel industry, and competition from high-quality ores from other sources. St. Louis County mines furnished 75 percent of the total usable ore shipped from the State. Concentrates furnished 67 percent of the total, the

remainder was direct-shipping grades. Operating companies and mines from which ore was shipped in 1962 were as follows:

Company:	*Mines*
The Hanna Mining Co	Agnew No. 2-South Agnew, Douglas, Duncan, Morton-South Eddy, North Uno, Pierce, and Weggum.
Jones & Laughlin Steel Corp	Longyear and Schley group.
W. S. Moore Co	Mariska and Yawkey.
North Range Mining Co	Nahma.
Oglebay Norton Co	St. James.
Oliver Iron Mining Division, United States Steel Corp.	Canton (0–39), Gilbert, Iron Range Reserve, Kosmerl, Pilotac, Pioneer, Rouchleau group, Sherman group, Soudan, and Stephens.
Pacific Isle Mining Co., Subsidiary of Inland Steel Co.	Iroquois, Wacootah "A" and Wacootah "B".
Pickands Mather & Co	Bennett Annex, Corsica, Erie Commercial, and Mahoning.
Pittsburgh Pacific Co	Albany group, Albany L.O.S.P., Laura L.O.S.P., Mary Ellen, Meadow, Missabe Mountain, and Wyoming.
Republic Steel Corp	Susquehanna.
Reserve Mining Co	Peter Mitchell.
Rhude & Fryberger	Boeing, Fayal Annex, Hull-Nelson, Pearsall, Security, and Troy.
Snyder Mining Co	Godfrey, Webb-Sellers Triangle, and Whiteside.
E. A. Young, Inc	Minnewas.
Zenith Mining Co	Zenith.

All operating mines were on the Mesabi Range with the exception of Soudan, Zenith, and Pioneer underground mines in the Vermilion Range. The only underground mines operating at the end of the shipping season were the Pioneer and the Albany group. Shut down during the season were Zenith and Soudan mines in the Vermilion Range and Godfrey mine, Mesabi Range. The first shipment of Minnesota iron ore was from the Soudan mine in 1884, and shipments have been made from the mine every year since.

Taconite concentrate shipments were about 2 percent below the record shipments of 1961. Nearly 14.0 million tons of taconite concentrates were shipped, about one-third of the State total iron-ore output. Erie Mining Co. (Pickands Mather & Co., operating agents) produced taconite concentrates throughout the year at the large-scale operations at Hoyt Lakes, shipping a record 7.7 million tons of taconite pellets. The company mined nearly 24.2 million tons of crude taconite ore during the year. Concentrate pellets were shipped 73 miles over the company railroad to the shipping port at Taconite Harbor. Erie continued its program of design modification and improvement. Erie Mining Co. made continuing tests of a cationic flotation process to improve its final magnetite concentrate. The company also diamond drilled a magnetic taconite deposit 20 miles northeast of the Hoyt Lakes operations and was evaluating the deposit to determine commercial possibilities. Reserve Mining Co. produced 18.5 million tons of crude ore at the Peter Mitchell mine near Babbitt. The crude taconite was crushed to about 3-inch size and shipped by interplant railroad to the Silver Bay plant of Reserve Mining Co. for final processing. As part of its major expansion program, the company installed a second primary 60-inch crusher at the mine.

Oliver Iron Mining Division continued to operate the Pilotac taconite mine and concentrator near Mountain Iron. Taconite concentrate was hauled to the Oliver Extaca plant near Virginia for agglomerating. Oliver gave up its lease on the Agnew No. 3 property near Hibbing. The Monroe group, normally an important shipper, was inactive. Major production tonnages for Oliver were shipped from the Rouchleau group, Sherman group, and the Stephens mine. Oliver reorganized its Mesabi Range operations, consolidating its iron range division offices with the general offices at Duluth.

Jones & Laughlin added additional spirals to the Schley group beneficiation plant. The company operated the Gilbert mine under contract for Oliver in conjunction with the Schley group.

Pickands Mather & Co. increased the capacity of the Mahoning wash plant by installing a larger primary screen and belt feeder. The Corsica mine, which was dewatered and rehabilitated in 1960, was exhausted of ore and the Embarrass mine, which was normally operated with the Corsica mine, was idle. The Erie Preliminary Taconite plant was sold for scrap.

W. S. Moore Co. did not operate the Judson, Judson Extension, and Mariska Extension, and leases on these properties were cancelled. In November, W. S. Moore and Northern Natural Gas announced plans to construct an experimental pilot plant in Duluth to conduct a research program to convert hematite into magnetite by reduction roasting. W. S. Moore was granted funds by the ARA and IRRRC to build an iron ore briquetting plant to develop means for using fine ores that are presently undesirable for use in blast furnaces. The North Range Mining Co. operated the Nahma mine, the crude ore from which was concentrated by a custom concentrator. Pittsburgh Pacific Co. installed a dry-screening plant at the Albany group and exhausted the Mary Ellen mine purchased from the Pioneer Mining Co. in 1961. The Meadow mine of Pittsburgh Pacific Co. was operated infrequently during the season. In 1962 Wilson Marine Transit Co. acquired a substantial interest in Pittsburgh Pacific Co. The latter company sold its subsidiary, Coons Pacific Co., to a group consisting of Common Interests, Inc., and former officers of Coons Pacific Co. The Wanless mine of Cleveland-Cliffs, which resumed shipments in 1961, was idle during 1962.

Pacific Isle Mining Co. operated the Iroquois and Wacootah mines on a reduced schedule.

The Hanna Mining Co. added a spiral classifier to the Pierce plant, replaced the vibrating screens at the Douglas with stationary screens, and added two classifiers to the Agnew No. 2-South Agnew tailings circuit. Shipments from the Hanna Weggum plant were only from stocks of concentrate.

Rhude & Fryberger resumed shipments from the Troy mine which had been idle since 1959. The Troy mine and concentrator were operated on a limited basis. The company shipped concentrate stocks from the Pearsall mine. It also built an ore-drying plant at the Security mine to dry ore mined at the Hull-Nelson. Snyder Mining Co. shipped stockpiled ore from the Godfrey mine, which was shut down December 1961. Snyder operated the Kosmerl mine of the Oliver Iron Mining Division under contract in conjunction with the Whiteside mine.

The American Steel & Wire Division of United States Steel Corp. operated coke ovens, blast furnaces, and basic open-hearth furnaces at Duluth. The Duluth blast furnace of Interlake Iron Corp., idle since late 1960, was permanently closed.

Universal Atlas Cement Division of United States Steel Corp. produced portland and masonry cements at Duluth. Total sales declined from 1961. The plant was closed temporarily during December. Cutler-Magner Co. produced quicklime and hydrated lime at Duluth. Total sales increased slightly. Moss peat was produced near Wawina by the Arrowhead Peat Co., and the St. Louis County Peat Products Co. produced reed-sedge peat at Central Lakes. Peat sales were primarily for soil improvement purposes. Peat was shipped in bulk and in packages.

A clay deposit was drilled by the IRRRC near Cook to determine whether a ceramics plant would be feasible in the area.

About 1.2 million tons of sand and gravel was produced in St. Louis County for building and road construction, railroad ballast, engine use, fill, and other purposes. Commercial producers included Arrowhead Sand and Gravel, Inc.; Biwabik Gravel Co., Inc.; E. W. Coons Co.; Jay W. Craig Co.; Duluth Missabe & Iron Range Railroad Co.; East Range Gravel Co.; Hallett Construction Co.; Kuitu Sand & Gravel Pit; Megarry Bros.; and Mesaba Construction Co. Operations were in the vicinity of Biwabik, Brimson, Cloquet, Duluth, Hibbing, Saginaw, and Virginia. The State and county highway departments produced and contracted for paving sand and gravel.

Zenith Dredge Co. produced crushed basalt for concrete aggregate and roadstone. Output decreased from that of 1961.

Mesaba Granite Co. did not operate its granite quarry near Mountain Iron in 1962.

Scott.—About 230,000 tons of crushed and broken limestone was produced at fixed plants near Shakopee and Savage for agricultural use, roadstone, asphalt filler, and riprap. Producers were B & R Rock Products Co., Bryan Rock Products, Inc., and Landers-Norblom-Christenson Co.

Approximately 395,000 tons of sand and gravel was produced principally near Shakopee, Belle Plaine, and Jordan. Fixed plants were operated by Belle Plaine Sand & Gravel, Haferman & Stark, Shakopee Sand & Gravel, and Minnesota Quartz Co. Output was for building, road construction, sand blasting, and other uses. The State and county highway departments produced and/or contracted for paving sand and gravel.

Stearns.—Cold Spring Granite Co. operated five granite quarries near Cold Spring, Rockville, St. Cloud, and St. Joseph and finishing plants at Cold Spring and St. Cloud. Output was chiefly for architectural purposes and monuments. Some granite was crushed at the Cold Spring plant and sold for poultry grit. The St. Cloud Red quarry of Cold Spring Granite Co. was inactive throughout the year. Delano Granite Works, Inc., quarried granite near Rockville for architectural and monumental purposes. North Star Granite Corp. produced granite from its No. 4 and 5 quarries near St. Cloud. The stone was processed at its plant in St. Cloud and sold for monuments. Crushed granite was produced by Shiely-Petters Crushed Stone Co.,

Inc., near Waite Park. The material was sold chiefly for railroad ballast and seal-coating for bituminous roads.

Megarry Bros. and A. C. Petters Co., Inc., produced sand and gravel near St. Cloud chiefly for use in building and road construction. The State and county highway departments produced and contracted for paving sand and gravel.

Steele.—Limestone was produced by Klemmer Construction Co., which operated a portable plant near Owatonna. Output was for roadstone, agriculture and riprap.

At its heavy-medium plant near Owatonna, Owatonna Aggregates Corp. produced about 105,000 tons of sand and gravel for building use. Ed Lundin Construction Co. operated a fixed plant at Owatonna and produced 57,000 tons of sand and gravel for building and paving use and fill. Ulland Bros., Inc., operated a portable plant and produced about 10,000 tons of paving gravel. Medford Sand & Gravel Co. produced sand and gravel for building use and fill at a fixed plant near Medford. The county highway department contracted for paving gravel.

Wabasha.—Crushed limestone was produced by Hector Construction Co., Inc.; Patterson Quarries, Inc.; and Quarve & Anderson Co. Output was for roadstone and agricultural purposes.

About 350,000 tons of sand and gravel was produced for building and road construction, railroad ballast, fill, and other uses. Producers included: Bennet & Son; Chicago, Milwaukee, St. Paul & Pacific Railroad Co.; Megarry Bros.; Art Schober; Wabasha Sand & Gravel Co.; and the State and county highway departments.

Washington.—Nearly 1.7 million tons of sand and gravel was produced in the county, about the same as in 1961. Producers included: Craig J. Alexander; Ashbach Construction Co.; Kimmes Bartelma Construction Co., Inc.; Cemstone Products Co.; Jay W. Craig Co.; R. J. Jager Gravel Co.; Moelter Construction Co., Inc.; Shalander & Shaleen; J. L. Shiely Co.; and the State and county highway departments. The material was used for building and road construction, railroad ballast, fill, and other purposes. J. L. Shiely Co. also produced crushed and broken limestone near St. Paul for roadstone and riprap. Nienaber Contracting Co. produced crushed limestone near Lake Elmo for road and agricultural purposes. Bryan Rock Products, Inc., produced crushed limestone for agricultural use at its Smith quarry near Marine on St. Croix.

Winona.—Dimension limestone was produced near Winona by the Biesanz Stone Co., Inc., chiefly for architectural use. Crushed limestone for road construction and agricultural use was produced by Fred Fakler, Hector Construction Co., Inc., Patterson Quarries, Inc., and Quarve & Anderson Co., all operating portable plants.

Winona Aggregate Co. produced sand and gravel for building and road construction and other uses at its dredging operation near Winona. An article describing the company operation was published.[6] The State highway department produced paving sand and gravel.

Wright.—Delano Granite Works, Inc., operated a sawing and finishing plant at Delano and processed rough granite quarried by the company in Big Stone and Stearns Counties.

[6] Rock Products. Natural Surge No Problems. V. 65, No. 6, June 1962, pp. 99–101.

About 377,000 tons of sand and gravel was produced in the county and used for building and road construction and fill. Producers included: Jay W. Craig Co.; Hanover Sand & Gravel Co.; Megarry Bros.; Edward Schramm Washed Sand & Gravel; and the State highway department. Paving sand and gravel was produced under contract for the State and county highway departments.

Yellow Medicine.—Crushed and broken granite for railroad ballast and riprap was produced near Granite Falls by The Green Co., contractor for the Great Northern Railway Co. Dimension granite for monuments was produced near Echo by the Signet Quarry Co., formerly August A. Evanson.

Deutz & Crow Co., Inc., processed sand and gravel at a fixed plant in Canby. Output was for building and road construction. The State highway department produced paving sand and gravel. The county highway department contracted for sand and gravel for paving use, fill, and other purposes.

The Mineral Industry of Mississippi

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Mississippi Geological Survey, for collecting information on all minerals except fuels.

By Nicholas A. Kendall [1] and Frederic F. Mellen [2]

VALUE of Mississippi mineral production increased to a record $209.4 million. Mineral fuels—petroleum, natural gas, and natural gas liquids—represented 89 percent of the total value.

Construction of the $125 million Standard Oil Co. of Kentucky refinery near Pascagoula proceeded ahead of schedule and should eventually provide employment for approximately 350 persons. Several units were scheduled to go on stream in July 1963.

TABLE 1. —Mineral production in Mississippi [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays---thousand short tons	1,104	$5,034	1,129	$5,742
Natural gas---million cubic feet	172,543	32,093	170,271	32,351
Natural gas liquids:				
Natural gasoline and cycle products thousand gallons	25,135	1,625	25,891	1,616
LP gases---do	15,510	700	20,401	732
Petroleum (crude)---thousand 42-gallon barrels	54,688	154,220	[2] 54,471	[3] 151,429
Sand and gravel---thousand short tons	5,920	5,903	7,001	7,262
Stone (includes shell)---do	913	1,044	1,199	1,266
Value of items that cannot be disclosed: Certain nonmetals		7,961		9,030
Total		[3] 208,580		209,428

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Preliminary figure.
[3] Revised figure.

Part of the crude oil to the refinery was to be supplied through a 104-mile, 20-inch pipeline from Ostrica near Buras, La., completed in November by Cal-Ky Pipeline Co. This pipeline, longest underwater pipeline in the Nation, was to be extended 50 miles west to connect with the California Co.'s 600-well Bay Marchand field, Lafourche Parish, La. This field was expected to supply 75 percent of the refinery's needs.

[1] Petroleum and Natural Gas Engineer, Bureau of Mines, Bartlesville, Okla.
[2] Director, Mississippi Geological Survey, Jackson, Miss.

Construction began on a $500-million, 13,500-acre static testing facility for Saturn and Nova-class rockets in Hancock County for the National Aeronautics and Space Administration. Over 500 scientists, engineers, and technicians would man the post. Gainesville, in Hancock County, was the central location of the activity.

Mississippi Power Co. completed constructing a third unit rated at 112,000 kilovolt-amperes at its steam-generating plant midway between Biloxi and Gulfport. The first two units had a capacity of 75,000 kilovolt-amperes each.

Construction of a port area for the city of Greenville on the Mississippi River by the U.S. Army Corps of Engineers was about 60 percent complete. The main line Mississippi River levee system in the State, 272 miles in length, was completed to the authorized grade and cross section. A program of channel cutoffs, inaugurated in the early 1930's as part of the flood control project, was completed. Channel improvements, including 16 cutoffs, reduced the river distance from Memphis, Tenn., to Baton Rouge, La., by 170 miles. Other works by the U.S. Army Corps of Engineers, such as flood control on the Yazoo River, were still in progress.

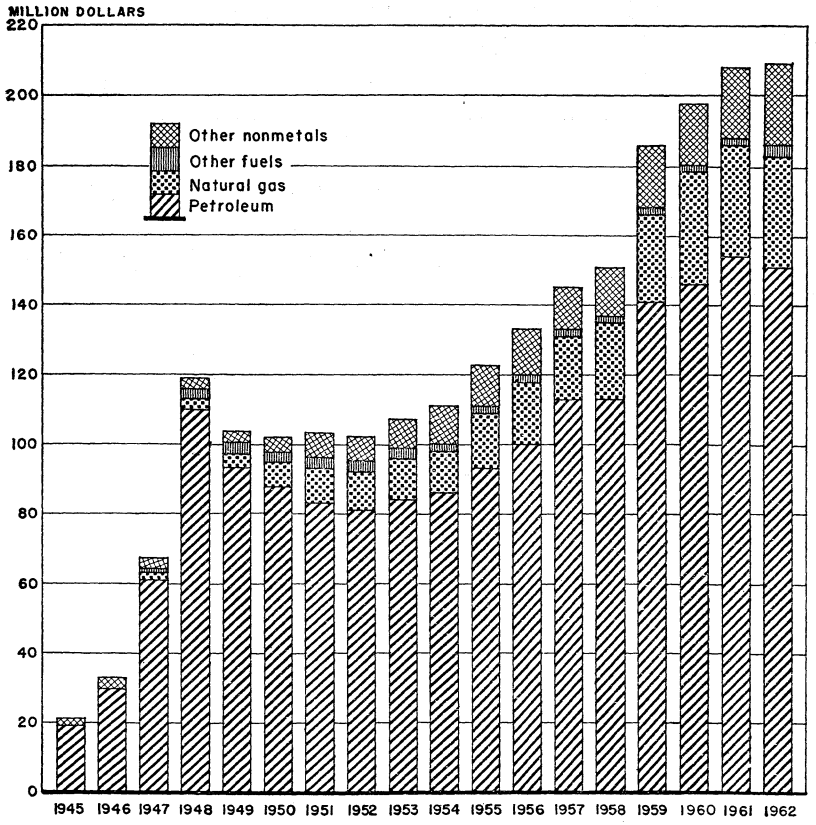

FIGURE 1.—Value of petroleum, natural gas, and total value of mineral production in Mississippi, 1945–62.

The Pearl River Valley Water Supply District was constructing the $25 million Ross R. Barnett Reservoir near Jackson. When completed, the reservoir would have a water supply capacity of 300,000 acre-feet and rank as the largest in the State.

Employment and Injuries.—Average employment in mineral industries remained about the same as in 1961, according to the Mississippi Employment Security Commission. Employment in petroleum and natural gas industries decreased 2 percent despite a 3 percent increase in drilling activity; wages and salaries increased 1 percent.

TABLE 2.—Employment and wages in the mineral industries [1]

Activity	Average number of workers		Total wages and salaries (thousands)	
	1961	1962	1961	1962
Crude petroleum production, natural gas, and natural gas liquids	1,720	1,795	$12,728	$13,377
Oil and gas field contract services	3,610	3,437	18,028	17,822
Sand and gravel quarries, pits, and dredges	795	877	2,961	3,481
Nonmetallic minerals	110	105	337	350
Total	6,235	6,214	34,054	35,030

[1] The Mississippi Employment Security Law covers 4 or more persons.
Source: Mississippi Employment Security Commission.

TABLE 3.—Total wage and salaried workers in petroleum production, refining, and related industries

Year	Crude petroleum and natural gas production	Petroleum refining [1]	Pipeline transportation (except natural gas)	Gas utilities	Petroleum bulk gas stations	Retail filling stations	Chemicals manufactured as by-products of petroleum or used in the refining of petroleum [2]	Total
1961	5,330	401	235	2,450	(3)	2,698	94	11,208
1962	5,232	392	202	2,376	(3)	2,585	92	10,879

[1] Employment in petroleum refineries and petrochemicals manufactured in petroleum refineries.
[2] Employment in petrochemical manufacturing facilities located outside petroleum refineries.
[3] Data not available.
Source: Mississippi Employment Security Commission.

A worker at Coastal Chemical Co., Pascagoula, died from suffocation when several tons of chemical fertilizer fell on him.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Value of natural gas, natural gas liquids, and crude petroleum declined for the first time in 10 years.

Mississippi again ranked ninth among the oil-producing States. The five leading petroleum-producing counties were Pike, Adams, Lincoln, Jasper, and Jones, in descending order.

Total drilling activity increased by 2.5 percent, compared to a national decrease of 1.7 percent. Average depth of all holes drilled was

8,938 feet, about 900 feet less than in 1961; total footage drilled decreased from 5.7 million feet to 5.4 million feet, according to the Oil & Gas Journal. Secondary recovery scored further gains, with continued waterflooding operations in McComb and Little Creek oilfields. Plans by Larco Drilling Co. to start injecting water into the Lower Tuscaloosa formation of Summit field in Pike County were approved by the Mississippi Oil and Gas Board. Permits were also issued to Humble Oil and Refining Co. and to Hess Oil and Chemical Corp. to start pilot water-injecting projects in the Eutaw formation of the East Eucutta field, Wayne County.

TABLE 4.—Oil and gas wells drilled in 1962, by counties

County	Development			Exploratory			Total
	Oil	Gas [1]	Dry	Oil	Gas	Dry	
Adams	27		21	5		30	83
Amite	15		15	2		11	43
Calhoun						1	1
Chickasaw						2	2
Claiborne						1	1
Clarke	18		9			8	35
Clay		1					1
Copiah						1	1
Covington	3		2			2	7
Forrest		3	4			1	8
Franklin	10		15	1		20	46
George						2	2
Greene						2	2
Hancock						1	1
Harrison						1	1
Hinds	1					3	4
Holmes						1	1
Issaquena						1	1
Jasper	4	1	1			7	13
Jefferson	4	1	8	1		7	21
Jefferson Davis		1				1	2
Jones	26		10			7	43
Kemper						1	1
Lamar	3	2	3			3	11
Leake						1	1
Lincoln	9		7			9	25
Madison	1		2			7	10
Marion	5	7	3			2	17
Monroe		4	5		1	3	13
Pearl River	2	7	6			4	19
Perry	1					2	3
Pike	7		9	1		8	25
Pontotoc						1	1
Rankin				1		1	2
Scott						2	2
Simpson	4		2			1	7
Smith	1		4	1		7	13
Stone						1	1
Tate						1	1
Tunica						1	1
Walthall	27	7	12			2	48
Wayne	18		12	1		14	45
Wilkinson	5		6	3		26	40
Yalobusha						1	1
Yazoo	9		2			5	16
Total: 1962	200	34	158	16	1	213	622
1961	201	45	151	10		200	607

[1] Includes condensate.

Source: Mississippi State Oil & Gas Bulletin. Jackson, Miss., v. 62, No. 1, March 1962, through No. 12, February 1963.

Seventeen new field discoveries were Pretty Creek, South Deerfield, Pine Mount, Hutchins Landing, and Arnot in Adams County; East Glading and East Hustler in Amite County; Eddiceton in

Franklin County; Cadillac in Jefferson County; East Muldon (gas) in Monroe County; Conerly in Pike County; Pelahatchie in Rankin County; Mize in Smith County; Wausau (dual completion) in Wayne County; and North Fort Adams, Ellis Lake, and East Kelly Hill in Wilkinson County. Of these, Mize and Wausau loomed as major discoveries because they contain multiple reservoirs.

Papers entitled "Geological History and Oil and Gas Possibilities of Mississippi" and "Stratigraphic Implications from Studies of the Mesozoic of Central and Southern Mississippi," were published by the Mississippi Geological Survey as part of its Bulletin 97, "Mississippi Geologic Research Papers, 1962." These papers are expected to encourage exploration in the State.

According to the Mississippi State Oil and Gas Bulletin, on December 31, 1962, the State had 236 oil pools and 48 gas pools producing in 211 fields; the 3,508 wells capable of producing represented a net increase of 165 wells over those of 1961.

TABLE 5.—Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

	Proved reserves, Dec. 31, 1961	Changes in proved reserves, due to extensions and new discoveries in 1962	Proved reserves, Dec. 31, 1962 (production was deducted)	Change from 1961, percent
Crude oil.....thousand barrels..	401,170	40,684	388,383	−3
Natural gas liquids [1].....do....	34,879	3,432	36,015	+3
Natural gas.....million cubic feet..	2,847,989	77,338	2,750,785	−3

[1] Includes condensate, natural gasoline, and LP gases.

Source: American Gas Association, American Petroleum Institute, and Canadian Petroleum Association. Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas. V. 17, Dec. 31, 1962, pp. 11, 12, 21.

Natural Gas.—Marketed production of natural gas amounted to 170 billion cubic feet valued at $32 million based on an average unit price of 19.0 cents per thousand cubic feet, compared with 18.6 cents in 1961. Five counties—Forrest, Adams, Marion, Walthall, and Pearl River—supplied 73 percent of the State production.

One new gas field was discovered (in Monroe County). Geologically, Monroe County is in the Black Warrior Basin, which occupies parts of northeastern Mississippi and northwestern Alabama. This basin was considered by some geologists to be a possible extension of the Arkoma Basin of northern Arkansas and eastern Oklahoma. Possibly because of successful exploration efforts in recent years in the Arkoma Basin, the Black Warrior Basin in Mississippi received special attention in 1962. Besides the new gas discovery, increased leasing and geophysical activities occurred in Lowndes, Monroe, Chickasaw, Calhoun, Lafayette, Pontotoc, Union, Marshall, Benton, and Tishomingo Counties. Mississippi Geological Survey Bulletin No. 96, entitled "The Tula Prospect, Lafayette County, Miss.," published in 1962, probably encouraged increased activity in the Black Warrior Basin, because a major company scheduled a 10,000-foot basement test. The bulletin reviewed productive possibilities of Ordovician, Cambrian, and Precambrian formations in northern Mississippi and recommended deeper exploration.

TABLE 6.—Marketed production of natural gas[1]

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1953–57 (average)	162,595	$15,062	1960	172,478	$32,426
1958	160,143	22,260	1961	172,543	32,093
1959	162,095	25,125	1962	170,271	32,351

[1] Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.

Natural Gas Liquids.—Output of natural gas liquids increased 14 percent in volume and 1 percent in value over that of 1961, reflecting a further decline in the average price per gallon from 5.7 cents in 1961 to 5.1 cents.

Sinclair Oil and Gas Co. placed its new gas processing plant near Laurel, Jones County, on stream in November; the plant processed gas produced with oil from the Pool Creek field and had a daily capacity of 5 million cubic feet. Shell Oil Co. increased the capacity of its Little Creek processing plant by 50 percent, and Sun Oil Co. increased the capacity of its McComb plant by 33 percent; both of these plants are in Pike County. Total capacity of the nine natural gas processing and cycling plants in the State was 375 million cubic feet per day.

According to the Oil and Gas Journal, a solution cavern in a Forrest County salt dome contained the following fuels on October 1962: Propane, 808,000 barrels; butane, 300,000 barrels; and LP gases, 1,937,000 barrels. Four companies had products in storage there.

TABLE 7.—Natural gas liquids production
(Thousand gallons and thousand dollars)

Year	Natural gasoline and cycle products		LP gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	26,476	$1,806	13,199	$538	39,675	$2,344
1958	25,738	1,658	9,208	503	34,946	2,161
1959	23,207	1,495	8,141	465	31,348	1,960
1960	23,648	1,552	10,151	564	33,799	2,116
1961	25,135	1,625	15,510	700	40,645	2,325
1962	25,891	1,616	20,401	732	46,292	2,348

Petroleum.—The volume of crude oil produced remained at about the 1961 level, but value decreased 2 percent to $151 million at an average unit value of $2.78 per barrel. As forecast by the Bureau of Mines, production followed demand very closely from month to month (table 9). Pike, Adams, Lincoln, Jasper, and Jones Counties accounted for about 55 percent of the crude oil production in the State. Approximately 16 percent (15 percent in 1961) of the total crude petroleum produced was refined in the State's 3 plants, which increased their capacity 34 percent to 28,200 barrels per stream day. The new Standard Oil Co. of Kentucky refinery at Pascagoula was expected to increase the refining capacity in the State to 133,200 barrels per stream day, but probably not more than 25 percent of its 105,000-barrel-per-day capacity would be available for Mississippi crude oil. However, this refinery would contribute substantially to the growth of the petrochemical industry in the State.

The discovery of 17 new fields was the highest since 1952, when 20 new fields were opened, an alltime record.

Hess Pipeline Co. purchased the Heidelberg-Mobile, Ala., crude oil pipeline from Gulf Pipeline Co. and extended it 65 miles with a 10-inch spur from Lumberton to the McComb oilfield.

TABLE 8.—Crude petroleum production

(Thousand barrels and thousand dollars)

Year	Production	Value	Year	Production	Value
1953–57 (average)	37,469	$95,156	1960	51,673	$146,235
1958	39,512	113,004	1961	54,688	154,220
1959	49,620	140,921	1962 [1]	54,471	151,429

[1] Preliminary figure.

TABLE 9.—Crude petroleum production, indicated demand, and stocks in 1962, by months

(Thousand barrels)

Month	Production	Indicated demand	Stocks originating in Mississippi
January	4,320	4,199	2,694
February	3,957	4,051	2,600
March	4,662	4,716	2,546
April	4,362	4,388	2,520
May	4,624	4,877	2,267
June	4,486	4,390	2,363
July	4,755	4,903	2,215
August	4,866	4,957	2,124
September	4,014	3,979	2,159
October	4,867	4,925	2,101
November	4,708	4,535	2,274
December	4,850	4,591	2,533
Total: 1962	[1] 54,471	54,511	----------
1961	54,688	54,461	----------

[1] Preliminary figure.

TABLE 10.—Crude petroleum production by fields [1]

(Thousand barrels)

Field	1958	1959	1960	1961	1962 [2]
Baxterville	4,819	5,801	5,901	5,949	5,808
Bolton	1,260	1,369	1,457	1,136	1,127
Brookhaven	2,396	1,928	1,924	1,571	1,498
Bryan	----------	1,222	2,487	3,391	2,068
Cranfield	1,428	805	1,099	901	905
Diamond	959	1,040	1,166	924	751
Eucutta	1,571	1,533	1,363	1,261	1,151
Heidelberg	3,205	3,262	3,302	3,974	3,737
La Grange and South	1,621	1,755	1,453	1,471	1,322
Little Creek	1,440	5,460	5,669	6,431	5,384
Mallalieu	727	761	601	562	596
McComb	----------	----------	2,533	2,949	4,383
Pistol Ridge Maxie	1,185	1,207	1,000	651	736
Raleigh	----------	2,138	2,157	1,820	1,392
Soso	4,204	4,695	3,901	3,418	2,998
Tinsley	3,800	3,421	3,234	2,991	2,835
Yellow Creek	1,360	1,292	1,170	1,222	1,492
Other fields [3]	9,537	11,931	11,256	14,066	16,288
Total	39,512	49,620	51,673	54,688	54,471

[1] Based on Oil and Gas Journal data adjusted to Bureau of Mines total.
[2] Preliminary figures.
[3] Bureau of Mines data.

Petrochemicals.—Yazoo County voted to issue $800,000 "Balance-Agriculture-With-Industry" (BAWI) bonds to assist Mississippi Chemical Corp. in building port, warehouse, and storage facilities. Incoming materials from Coastal Chemical Corp. at Pascagoula, an affiliate, would be bulk fertilizer, phosphate, liquefied ammonia, and sulfuric acid. Phosphate rock from Florida would also be utilized in the new facilities.

Canton Treating Co. completed the construction of a creosoting plant at Canton, Madison County, and Southbridge Plastic Products completed a vinyl plastics plant at Corinth, Alcorn County.

Allied Chemical Corp., New York, started producing insecticide at its new plant at Prairie in Monroe County. The plant employed 50 people to manufacture Mirex, an insecticide for controlling fire ants in the South.

NONMETALS

Cement.—Production of portland cement increased 15 percent over that of 1961, but output of masonry cement remained about the same. Mississippi Valley Portland Cement Co. was expanding the capacity of its wet-process plant at Redwood, Warren County, from 800,000 barrels to 2 million barrels annually.

TABLE 11.—Shipments of portland cement to Mississippi consumers

Year	Mississippi (thousand barrels)	Change, percent	
		Mississippi	United States
1953–57 (average)	1,900		
1958	2,778	+27	+6
1959	3,072	+11	+9
1960	3,324	+8	−7
1961	3,603	+8	+3
1962	3,704	+3	+3

Clays.—Production of clay was up 2 percent over that of 1961, establishing a new record for the third consecutive year. Increases were reported in quantities of ball clay, bentonite, and fuller's earth sold or used. Total tonnage of miscellaneous clay, used for manufacturing heavy clay products and lightweight aggregate, was down 1 percent and constituted 57 percent of the clay production in the State. Bentonite production increased 21 percent over that of 1961. Output of fuller's earth from Tippah County increased 8 percent, and fire clay production dropped 16 percent. Ball clay was produced in Panola County.

H. K. Porter Co., Inc., was expanding its basic refractories plant at Pascagoula. The $675,000 program would increase plant capacity by 25 percent. The plant was constructed in 1958 at a cost of $12 million to manufacture basic brick and specialties.

The Mississippi Geological Survey published a paper, "Economic Potential of Alumina-rich Clays and Bauxite in Mississippi," as part of its "Research Papers, 1962," Bulletin No. 97.

Ceramic wall tile production progressed at the new Gulf States

Ceramic Corp. plant at Houston, Chickasaw County. The production line and processes for the first glazed wall tile unit neared completion. The plant employed 60 people.

TABLE 12.—Clays sold or used by producers, by kinds
(Thousand short tons and thousand dollars)

Year	Bentonite		Ball clay, fire clay, and fuller's earth		Miscellaneous clay		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	208	$2,263	81	$889	321	$328	610	$3,480
1958	177	2,081	106	964	293	293	576	3,338
1959	200	2,494	117	1,138	430	432	747	4,064
1960	238	2,900	181	1,287	598	599	1,017	4,786
1961	228	2,836	226	1,547	650	651	1,104	5,034
1962	276	3,429	207	1,666	646	647	1,129	5,742

Magnesium Compounds.—H. K. Porter Co., Inc., Pascagoula, continued to produce magnesium compounds. Production, declining for the second consecutive year, dropped 9 percent. Magnesium-bearing lime made from dolomite mined in Alabama was used in the process.

Salt.—International Salt Co. is continuing engineering feasibility studies aimed toward developing an underground salt mine in the Bruinsburg salt dome near Port Gibson.

The Atomic Energy Commission planned to excavate a cavern in Tatum salt dome, Lamar County, for its Project Dribble. The 95-foot-diameter sphere, 2,000 feet below the surface, would require the removal of a total of 30,000 cubic yards of salt and rock, including the access and vent shafts. Project Dribble called for detonating three nuclear devices of varying strengths to assist in seismic research.

Sand and Gravel.—Output of sand and gravel increased 18 percent in tonnage and 23 percent in value compared with 1961. The gain resulted from increased highway construction and more complete reporting by producers. Sand and gravel production was reported from 20 of the 82 counties in the State; leading producers in descending order of value were Copiah, Forrest, Hinds, De Soto, and Adams Counties. These five counties produced 57 percent of the tonnage and 54 percent of the value.

TABLE 13.—Sand and gravel sold or used by producers
(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	4,356	$3,741	485	$281	4,841	$4,022
1958	5,614	5,149	931	1,091	6,545	6,240
1959	6,921	7,199	599	544	7,520	7,743
1960	6,068	5,522	113	46	6,181	5,568
1961	5,536	5,314	384	589	5,920	5,903
1962	6,394	6,336	607	926	7,001	7,262

TABLE 14.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	710	$590	847	$660
Paving	999	890	1,113	922
Other [1]	58	129	74	153
Total	1,767	1,609	2,034	1,735
Gravel:				
Building	991	976	1,377	1,532
Paving	2,675	2,670	2,767	2,925
Other [2]	103	59	216	144
Total	3,769	3,705	4,360	4,601
Total sand and gravel	5,536	5,314	6,394	6,336
Government-and-contractor operations:				
Sand: Paving	184	195	299	303
Gravel: Paving	200	394	308	623
Total sand and gravel	384	589	607	926
Grand total	5,920	5,903	7,001	7,262

[1] Includes molding, engine, (1961), and other construction and industrial and ground sand (1962).
[2] Includes railroad ballast, fill, and miscellaneous gravel.

TABLE 15.—Sand and gravel production in 1962, by counties

County	Short tons	Value
Amite	4,300	$1,720
Bolivar	48,843	63,677
Clay	73,217	61,635
Holmes	292,700	351,240
Le Flore	30,000	15,000
Lowndes	580,174	412,615
Monroe	205,137	147,480
Pearl River	36,600	37,500
Smith	3,000	1,200
Yazoo	43,500	18,000
Other counties [1]	5,683,857	6,152,294
Total	7,001,328	7,262,361

[1] Includes Adams, Copiah, De Soto, Forrest, Harrison, Hinds, Panola, Perry, Tishomingo, and Yalobusha Counties combined to avoid disclosing individual company confidential data. Undistributed amounts from various counties are also included.

In October, Jahncke Service, Inc., New Orleans, La., obtained a 5-year lease from the State to dredge and remove a maximum of 100,000 cubic yards of sand per year from tidelands for which the State would receive 9.5 cents per cubic yard. Operations started immediately with the dredging of sand from the Gulf of Mexico off Harrison County. The sand was barged to St. Louis, Mo., to be manufactured into automobile glass at the Libbey-Owens Ford plant there. This was the first year that glass sand production was reported in the State.

The Mississippi Geological Survey published Bulletin No. 93, "Heavy Minerals of Sand from Recent Beaches of the Gulf Coast of Mississippi and Associated Islands." A continuation of this work

was Report of Investigations 6024, "Reconnaissance of Titanium Resources on Ship Island, Harrison County, Miss.," by the Bureau of Mines.

Stone.—Increased production of Government-and-contractor crushed limestone accounted for an overall gain. Oyster and clam shell, dredged offshore of Harrison County, was about half the amount reported in 1961.

Sulfur.—Tonnage and value of recovered sulfur increased 8 percent compared with 1961. Sulfur was recovered from refinery gases at Pontiac Eastern Corp. refinery near Purvis, Lamar County.

METALS

Manganese.—In May, American Potash and Chemical Corp. began producing manganese in its new $6 million electrolytic plant near Aberdeen, Monroe County. The manganese was recovered from ore imported from India and Pakistan and sold to steel plants throughout the Nation. The new plant, with an annual capacity of 10 million pounds, was adjacent to the company's sodium chlorate plant.

Iron Ore.—Mississippi State Geological Survey continued studying the iron ore resources, including geologic mapping, mineralogic studies, and chemical analyses of core samples.

REVIEW BY COUNTIES

Only counties with significant mineral production are discussed below; see table 16 for additional details.

Adams.—For the third consecutive year, Adams County led in total value of minerals produced, and ranked second in petroleum and natural gas production, producing about 22 percent of the natural gas and 11 percent of the crude oil in the State. A total of 83 new holes having been drilled, the county led the State in drilling activity. Five new oilfields, Pretty Creek, South Deerfield, Pine Mount, Hutchins Landing, and Arnot, were discovered as the result of 35 exploratory wells being drilled. Development drilling added 27 oil wells to producing fields. The county ranked fifth in value of sand and gravel produced and accounted for about half of the total regenerated lime production in the State.

Alcorn.—Corinth Brick & Tile Co. mined clay near Corinth for manufacturing brick and tile. Southbridge Plastics Products, Inc., completed construction at Corinth of a vinyl plastic plant employing 400 workers.

Amite.—The exploratory drilling of 13 wells resulted in the discovery of 2 new oilfields, East Glading and East Hustler. Development drilling added 15 new oil wells to existing fields. The county ranked fifth in the State in drilling activity, a total of 43 wells having been drilled.

Attala.—Kan-Kote, Inc., completed an electroplating plant at Kosciusko that employed 15 workers.

Chickasaw.—Gulf States Ceramic Corp. completed construction of a ceramics plant at Houston, employing 60 persons.

Clarke.—Eighteen new oil wells were added to producing fields by development drilling. A total of 35 holes were drilled during 1962, including 8 unsuccessful exploratory wells.

Clay.—Near Cedar Bluff, the Division of Lime, Mississippi Department of Agriculture, continued producing agricutural limestone from open pits. West Point Gravel Co. produced washed sand and gravel for highway and building construction. The development well drilled in the county was a gas producer.

TABLE 16.—Value of mineral production in Mississippi, by counties [1]

County	1961 [2]	1962	Minerals produced in 1962 in order of value
Adams	$27,680,223	$25,967,205	Petroleum, natural gas, sand and gravel, natural gas liquids.
Alcorn	(3)	(3)	Clays.
Amite	2,785,340	5,380,497	Petroleum, natural gas, sand and gravel.
Attala	(3)	(3)	Clays.
Bolivar	65,270	63,677	Sand and gravel.
Carroll	11,339	(3)	Clays.
Chickasaw	23,485	21,159	Natural gas, clays.
Clarke	1,157,658	1,358,533	Petroleum, natural gas.
Clay	443,448	697,005	Natural gas, sand and gravel, petroleum, natural gas liquids.
Copiah	(3)	(3)	Sand and gravel.
Covington		888,366	Petroleum, natural gas.
De Soto	409,957	(3)	Sand and gravel.
Forrest	9,294,085	10,921,476	Natural gas, petroleum, sand and gravel, natural gas liquids, clays.
Franklin	3,229,872	3,526,108	Petroleum, natural gas.
Greene	2,447		
Grenada	30,000		
Hancock	772,904	565,606	Natural gas, petroleum.
Harrison	(3)	(3)	Shell, sand and gravel.
Hinds	4,500,110	4,259,612	Petroleum, sand and gravel, clays, natural gas.
Holmes	280,000	351,240	Sand and gravel.
Itawamba	(3)	(3)	Clays, natural gas.
Jackson	(3)	(3)	Lime, magnesium compounds.
Jasper	16,480,945	14,940,163	Petroleum, natural gas.
Jefferson	4,639,046	4,429,803	Do.
Jefferson Davis	3,414,525	3,388,939	Natural gas, petroleum.
Jones	14,123,610	14,557,694	Petroleum, natural gas, natural gas liquids, clays.
Lamar	12,407,114	11,669,362	Petroleum, natural gas.
Lauderdale	10,000	10,000	Clays.
Lee	(3)	(3)	Do.
Le Flore	21,000	15,000	Sand and gravel.
Lincoln	19,123,896	15,306,146	Petroleum, natural gas, natural gas liquids, clays.
Lowndes	523,790	436,915	Sand and gravel, clays.
Madison	705,523	559,086	Petroleum, natural gas.
Marion	5,516,327	7,028,851	Natural gas, petroleum, natural gas liquids.
Marshall	(3)	(3)	Clays.
Monroe	3,246,721	3,329,669	Clays, natural gas, sand and gravel, petroleum.
Noxubee	170,154	(3)	Clays.
Panola	(3)	(3)	Clays, sand and gravel.
Pearl River	4,121,250	4,520,904	Natural gas, petroleum, sand and gravel, clays.
Perry	(3)	(3)	Sand and gravel, petroleum.
Pike	21,886,968	25,808,577	Petroleum, natural gas liquids, natural gas.
Pontotoc	10,150	8,300	Clays.
Prentiss	6,375	3,800	Do.
Rankin	4,958,737	5,740,904	Cement, stone, petroleum, natural gas.
Scott	58,364	34,761	Petroleum.
Sharkey	5,237	1,909	Do.
Simpson	5,509,669	5,646,439	Petroleum, natural gas.
Smith	9,722,912	7,921,906	Petroleum, clays, natural gas, sand and gravel.
Sunflower	9,674	(3)	Clays.
Tippah	(3)	(3)	Do.
Tishomingo	(3)	(3)	Sand and gravel, stone.
Walthall	2,028,369	5,562,381	Natural gas, petroleum.
Warren	(3)	(3)	Cement, stone.
Wayne	9,662,105	9,157,358	Petroleum, natural gas.
Wilkinson	1,647,761	1,477,604	Do.
Yalobusha	(3)	(3)	Sand and gravel.
Yazoo	9,282,892	8,402,353	Petroleum, sand and gravel, natural gas.
Undistributed	8,600,748	5,468,692	
Total	208,580,000	209,428,000	

[1] The following counties were not listed because no production was reported: Benton, Calhoun, Choctaw, Claiborne, Coahoma, George, Humphreys, Issaquena, Kemper, Lafayette, Lawrence, Leake, Montgomery, Neshoba, Newton, Oktibbeha, Quitman, Stone, Tallahatchie, Tate, Tunica, Union, Washington, Webster and Winston.

[2] Revised figures.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Copiah.—The county led the State in quantity and value of sand and gravel produced.

Covington.—The Collins oilfield, discovered in 1961, was expanded by three more oil wells. Two exploratory holes were dry.

De Soto.—The county ranked fourth in value of sand and gravel produced. Plastic Laminates, Inc., began producing plastic products in its new plant at Walls employing 150 workers.

Forrest.—The county led in natural gas production, producing approximately 22 percent of the natural gas in the State. Development drilling resulted in three new gas wells and four dry holes. The county ranked second in quantity and value of sand and gravel production. Clay for face brick and structural tile was quarried by Hattiesburg Brick Works.

Franklin.—Exploratory drilling of 21 wells resulted in the discovery of the Eddiceton oilfield. Development drilling resulted in 10 new oil wells and 15 dry holes. The county ranked third in drilling activity with 46 holes drilled.

Hancock.—National Aeronautics and Space Administration began constructing a $500 million test center near Gainesville for static-testing of Saturn and Nova-class launch vehicles. The completed center would be manned by more than 500 scientists, engineers, and technicians. Industrial Electric, Inc., started production in its porcelain enamelware plant at Bay St. Louis; 100 workers were employed.

Harrison.—Jahncke Service, Inc., started dredging glass sand from tidelands under a 5-year State lease. This was the first glass sand production reported in Mississippi. Shell for manufacturing lime was dredged from Mississippi Sound.

Hinds.—One development well was an oil producer, and three exploratory holes were dry. The county retained its lead in the quantity of miscellaneous clay mined and used for manufacturing face brick and other clay products and ranked third in the quantity and value of sand and gravel produced.

Jackson.—The first units of the $125 million Standard Oil Co. of Kentucky refinery at Pascagoula were expected to go on stream about mid-1963. Capacity was increased to 105,000 barrels per stream day from 100,000.

Lime produced from Alabama dolomite and shell at the H. K. Porter Co., Inc., plant at Pascagoula accounted for about half of the lime output in the State. The plant continued to produce magnesium compounds. Expansion of the refractories producing capacity was completed and 10 persons were added to the payroll.

Jasper.—The county continued to rank fourth in the State as a petroleum producer, accounting for 10 percent of the State production. Of six development wells drilled, four were oil producers, one was a gas producer, and one was a dry hole. Seven exploratory tests were dry.

Jefferson.—Exploratory drilling resulted in the discovery of the Cadillac oilfield, but seven were dry holes. Development drilling added four new oil producers and one new gas well to producing fields, and eight holes were dry.

Jefferson Davis.—The county dropped to sixth place in production of natural gas. Development drilling added one gas well to existing fields, and one exploratory well was dry.

Jones.—The county ranked fifth in drilling activity with 43 holes drilled. Development drilling resulted in 26 oil producing wells and 10 dry hoes; 7 exploratory wells were dry. The county ranked fifth in oil production, accounting for 9 percent of the State production.

Kemper.—Tennessee Gas Pipeline Co. completed its compressor station at De Kalb on its interstate gasline system.

Lamar.—Development drilling added three oil wells and two gas wells to existing fields; three development tests and three exploratory tests were dry. Sulfur production by Pontiac Eastern Corp. at its refinery near Purvis was 9 percent above the 1961 output. Storage of LPG products in caverns in a salt dome continued. Tennessee Gas Pipeline Co. finished a pipeline compressor station at Purvis.

Lincoln.—The county ranked third in total mineral production value and third in oil output, producing 10 percent of the total oil in the State. Development drilling resulted in nine oil producers and seven dry holes; nine exploratory wells were unproductive.

Lowndes.—General Tire and Rubber Co. started production in its new plastics plant at Columbus.

Madison.—Development drilling resulted in one new oil producer and two dry holes; seven exploratory tests were unproductive. Canton Treating Co. opened its new creosoting plant at Canton. Amid Plastics began production at its new plastics plant at Madison, employing about 100 workers.

Marion.—The county again ranked third in natural gas production, producing 11 percent of the State total. Development drilling added five oil wells and seven gas wells to proven fields. Exploratory drilling resulted in two dry holes.

Marshall.—Holly Springs Brick & Tile Co. and Southern Brick & Tile Co. mined fire clay and miscellaneous clay from open pits to make building brick.

Monroe.—The county retained its lead in value of clay production, accounting for 36 percent of the State total. Bentonite was mined from open pits and processed for mold-making, absorbing, filtering, and decolorizing. Exploratory drilling resulted in the discovery of the East Muldon gasfield and three dry holes. Development drilling added four gas wells to proven fields.

American Potash and Chemical Corp. began producing manganese from imported ore at its new $6 million electrolytic plant near Aberdeen in May. The new plant had an annual capacity of 10 million pounds and employed approximately 100 workers.

Allied Chemical Corp. started producing an insecticide at its new Prairie plant employing 50 workers.

Monroe Manufacturing Co. began producing plastics at its new Aberdeen plant that was built with the help of BAWI and revenue bonds.

Panola.—Substantial production of ball clay for glass-refractory use and washed sand and gravel for highway and structural uses was reported. Dehner Manufacturing Co. began producing laminated plastics at its new plant at Como employing 12 persons.

Pearl River.—The county continued to rank fifth in natural gas production, accounting for 9 percent of the gas produced in the State. Development drilling of 15 holes resulted in 2 oil producers, 7 gas producers, and 6 dry holes. Four exploratory holes were dry.

Pike.—Exploratory drilling resulted in the discovery of the Conerly oilfield; eight other exploratory tests were dry. Seven new oil wells were added to proven oilfields and nine development wells were dry. The county ranked second in total value of minerals and led in petroleum production, accounting for over 15 percent of the oil in the State. Croft Aluminum Co. began producing aluminum products at its new plant at Osyka. Farmers Milling and Seed Co. started producing fertilizer at its new plant at Magnolia.

Rankin.—Exploratory drilling resulted in the discovery of the Pelahatchie oilfield; one other exploratory hole was dry. Marquette Cement Manufacturing Co., one of the State's two cement plants, produced portland and masonry cement at its plant in Brandon.

Simpson.—Development drilling resulted in four oil wells and two dry holes; one exploratory test was dry.

Smith.—The Mize oilfield, discovered in December, appeared to be a major find because of the multiple producing zones in the field; seven other exploratory tests were dry. Development drilling brought in one oil producer, and four holes were dry.

Tippah.—The county ranked second in value of clay produced and was again the only producer of fuller's earth in the State.

Walthall.—The county ranked second in drilling activity with 48 wells drilled. Development drilling added 27 oil wells and 7 gas wells to proved fields, and 12 holes were dry. Two exploratory wells were unsuccessful. The county ranked fourth in production of gas.

Warren.—Mississippi Valley Portland Cement Co. expanded the grinding capacity of its wet-process plant at Redwood from 800,000 barrels to 1 million barrels annually and its kiln capacity to 2 million barrels of clinker.

Washington.—United States Gypsum Co. expanded its Greenville chemical plant adding 125 people to the payroll.

Wayne.—The county ranked fourth in drilling activity with 45 wells drilled. The discovery well for the Wausau field was dually completed, but 14 other exploratory holes were dry. Development drilling added 18 new oil wells to existing fields, and 12 holes were dry.

Wilkinson.—Exploratory drilling discovered North Fort Adams, Ellis Lake, and East Kelly Hill oilfields, and 26 other holes were dry. Development drilling added five oil wells to proven fields, and six holes were dry. The county ranked sixth in drilling activity with 40 wells drilled.

Yazoo.—Mississippi Chemical Corp. began constructing additional port, warehouse, and storage facilities at Yazoo City after the county approved an $800,000 BAWI bond issue; 20 workers would be added to the payroll. Development drilling resulted in nine new oil wells in proven fields and two dry holes, five exploratory holes were dry.

The Mineral Industry of Missouri

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Division of Geological Survey and Water Resources, Department of Business and Administration of Missouri, for collecting information on all minerals except fuels.

By W. G. Diamond [1] and William C. Hayes [2]

VALUE of Missouri Mineral production in 1962 totaled $153 million, $2 million more than in 1961. Sixteen mineral commodities were produced in the State—five metals, eight nonmetals, and three mineral fuels. The principal mineral commodities in order of value were cement, stone, lime, coal, sand and gravel, and lead. Mineral output was reported from 104 of the 114 counties. Nonmetals comprised 81 percent of the total value, metals 11 percent, and mineral fuels 8 percent. As a result of a labor strike, which began on July 27 and lasted to yearend, Missouri failed to lead the Nation in lead production for the first time since 1907.

TABLE 1.—Mineral production in Missouri [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite—short tons	227,323	$3,052	303,945	$3,994
Cement:				
Portland—thousand 376-pound barrels	11,839	41,142	12,739	44,004
Masonry—thousand 280-pound barrels	437	1,398	455	1,457
Clays—thousand short tons	2,132	5,040	2,053	5,033
Coal (bituminous)—do	2,938	12,567	2,896	12,057
Copper (recoverable content of ores, etc.)—short tons	1,479	887	2,752	1,695
Iron ore (usable)—thousand long tons, gross weight	341	3,633	346	3,188
Lead (recoverable content of ores, etc.)—short tons	98,785	20,350	60,982	11,221
Lime—thousand short tons	1,173	13,873	1,176	13,703
Natural gas—million cubic feet	90	22	92	23
Petroleum (crude)—thousand 42-gallon barrels	72	(2)	[3] 55	(2)
Sand and gravel—thousand short tons	9,371	10,688	10,304	11,572
Silver (recoverable content of ores, etc.) thousand troy ounces	12	11	491	533
Stone—thousand short tons	25,631	36,577	28,876	44,006
Zinc (recoverable content of ores, etc.)—short tons	5,847	1,345	2,792	642
Value of items that cannot be disclosed: Native asphalt, cobalt (1961), gem stones, nickel (1961), and values indicated by footnote 2	----	703	----	179
Total	----	[4] 151,288	----	153,307

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Preliminary figure.
[4] Revised figure.

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A preliminary report on present and future economic impact of mining and related industries in Meramec River Basin was prepared at the request of the St. Louis District, U.S. Army Corps of Engineers. The report included historical and current data, and projections relating to future output, employment requirements, and water use for the mineral industries in the Meramec River Basin. Data from this preliminary report are given in the commodity and county sections of this chapter.

Development.—A development contract with St. Joseph Lead Co. for mining lead-zinc ores in the Viburnum area was approved by the U.S. Department of the Interior. The contract covers 14,173 acres and was the first of its kind recommended by the Federal Geological Survey under provisions adopted in 1958 to promote conservation through integrated mining on land acquired by the Government. All royalties on production from Federal land must be accounted for separately in accordance with the lease provisions.

St. Joseph Lead Co. developed additional ore reserves in the Viburnum area of Washington, Crawford, and Iron County, according to the company annual report. Production of ore at the second shaft (No. 28 in Crawford County) began on January 1. Development of the third production shaft (No. 29 in Washington County) was suspended in July because of a strike. Capacity of the mill was increased to 6,000 tons of ore per day.

About 20 miles south of Viburnum, preliminary investigations were conducted for a millsite to process lead ore in the Oates area, Reynolds County.

Meramec Mining Co. continued development of the Pea Ridge iron-ore body. At yearend, primary and secondary crushing plants were completed, the mill was 75 percent completed, and pelletizing plant 20 percent completed. Development of the ore body continued on 4 levels, 150 feet apart, with the lowest level at 2,275 feet below the surface. First production of pellets was expected during 1963.

Granite City Steel Co. and American Zinc, Lead & Smelting Co. analyzed reports from consultants on mining methods, mining costs, metallurgy, and beneficiation methods, to determine the feasibility of developing an iron-ore body near Bourbon.

Exploration.—Minerals exploration activity continued on a large scale. Major companies conducting exploration in 1961 continued this work in 1962. Several additional companies started exploration programs.

American Zinc, Lead & Smelting Co. and Hecla Mining Co. began a joint exploration program for ore deposits in Iron and St. Francois Counties and other areas in southeast Missouri. The area under lease and option, including both private and public lands, totaled about 16,000 acres.

Schafer-Coleman Mining Corp. prospected for copper near Old Mines in Washington County. The company leased over 1,200 acres, and planned to lease 3,500 additional acres.

Homestake Mining Co. of San Francisco, Calif., applied for prospecting permits on 20,000 acres in Wayne County.

International Minerals & Chemical Co. opened an office in Potosi and began exploration for barite in Washington County.

Petrolini Corp. leased land in Mississippi County for oil or gas exploration. Between 30,000 and 35,000 acres were to be leased.

Employment.—Average employment declined 9 percent in the metal-mining industry and 1 percent in the coal-mining industry. Nonmetal-mining employment increased 3 percent.

TABLE 2.—Average annual employment of mining industries

Industry	1958	1959	1960	1961	1962
Metal mining	3,540	3,263	3,195	2,700	2,463
Nonmetal mining	3,941	4,286	3,820	3,950	4,077
Coal mining	800	856	864	777	769
Total	8,281	8,405	7,879	7,427	7,309

Source: Division of Employment Security, Department of Labor and Industrial Relations, State of Missouri.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Missouri ranked first in tonnage of barite mined and shipped, and first in value of shipments in the Nation. Barite was mined in Washington and Miller Counties and processed at grinding plants in Washington and St. Louis Counties. Shipments of barite totaled 303,945 tons valued at $4 million.

Since 1872, when the first sale of barite in Missouri was recorded, over 8 million tons of barite valued at more than $74 million has been produced in the State. Principal uses of barite, in order of importance, in 1962 were drilling fluids, glass, rubber, and paint. All barite produced was mined by open-pit methods; average depth of pits was about 20 feet.

Imports of barite have significantly altered traditional patterns of supply. In 1950, imports represented 8 percent of supply, compared with the 1960 figure of more than 45 percent.

TABLE 3.—Barite sold or used by producers

Year	Short tons	Value	Year	Short tons	Value
1953–57 (average)	341,248	$3,758,023	1960	180,702	$2,587,820
1958	199,268	2,666,496	1961	227,323	3,051,663
1959	296,093	3,923,651	1962	303,945	3,994,104

Demand for Missouri barite has not kept pace with total national demand. From 1929 to 1960 demand for Missouri barite increased at an average annual rate of 1.4 percent; demand for the Nation increased 4.2 percent per year. Competition from barite produced in Arkansas and from imports has contributed to a lower rate of growth and a relatively static price structure.

In 1962 shipments of crude barite to grinding plants in Texas, Arkansas, and other States were by rail; shipments to plants in Missouri were by truck.

Cement.—Cement plants in St. Louis, Cape Girardeau, Jackson, and Ralls Counties produced 12.2 million barrels of portland cement, utilizing an average 75 percent of total capacity. More than 4.9 million barrels was produced by the dry-process method and nearly 7.3 million barrels by the wet-process method. The shipping pattern continued to change, with truck shipments comprising 47 percent of the total 12.7 million barrels shipped, compared with 32 percent in 1961 and 4 percent in 1960. About 50 percent of the cement was shipped to consumers within the State, and 50 percent to consumers in seven contiguous states.

TABLE 4.—Portland cement production and shipments

(Thousand barrels and thousand dollars)

Year	Production	Shipments		Year	Production	Shipments	
		Quantity	Value			Quantity	Value
1953–57 (average)	11,358	11,261	$32,754	1960	12,606	11,856	$40,915
1958	12,143	11,813	39,376	1961	11,940	11,839	41,142
1959	13,610	13,583	45,430	1962	12,239	12,739	44,004

Distribution of shipments by type of customer included ready mixed concrete producers, 57 percent; highway contractors, 15 percent; concrete product manfacturers, 11 percent; building material dealers, 9 percent; other contractors, 6 percent; and miscellaneous customers, 2 percent.

Marquette Cement Manufacturing Co. supplied cement for constructing the navigation lock of Barkley Dam on the Cumberland River in Kentucky. Shipments from the Cape Girardeau plant were made in closed barges carrying up to 7,000 barrels of cement in bulk, The barges were unloaded by vacuum pump into a silo at a rate of 400 barrels per hour.

Production of masonry cement increased 18 percent over that of 1961; shipments increased 4 percent. About one-fourth of the masonry cement was shipped to consumers in the State, and three-fourths to consumers in seven contiguous states.

TABLE 5.—Shipments of portland cement to Missouri consumers

Year	Missouri (thousand barrels)	Change percent		Year	Missouri (thousand barrels)	Change percent	
		Missouri	United States			Missouri	United States
1953–57 (average)	7,356			1960	7,684	−13	−7
1958	7,636	+11	+6	1961	8,066	+5	+3
1959	8,825	+16	+9	1962	8,814	+9	+3

Clays.—Missouri ranked high in manufacturing refractories because of its many deposits of fire clay, especially suitable for superduty refractories. Fire clay was mined in 13 counties and comprised 53 percent of the tonnage, and 81 percent of the value of clay production. Refractories were produced by Kaiser Refractories and Chemicals

Division, Kaiser Aluminum and Chemicals Corp.; A. P. Green Fire Brick Co., Harbison-Walker Refractories Co., Walsh Refractories Corp., Refractories Division, H. K. Porter Co., Inc., Wellsville Fire Brick Co., General Refractories Co., and North American Refractories Co.

Miscellaneous clay output declined 5 percent in tonnage and value, and accounted for 47 percent of the clay tonnage and 19 percent of the value. Lightweight aggregate was produced from shale in Platte County by Carter-Waters Corp. Heavy clay products and cement were made from miscellaneous clay, mined in nine counties.

TABLE 6.—Clays sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Fire clay		Diaspore		Burley		Miscellaneous clay		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	1,484	$6,284	20	$306	37	$309	832	$1,022	2,373	$7,921
1958	1,176	4,806	9	143	27	190	848	847	2,060	5,986
1959	1,623	5,630	6	93	28	197	978	978	2,635	6,898
1960	[1] 1,508	5,867	4	73	29	268	999	999	2,540	7,207
1961	[1] 1,096	3,901	8	64	8	55	1,020	1,020	2,132	5,040
1962	1,061	3,848	(2)	(2)	(2)	(2)	973	973	2,053	5,033

[1] Includes ball clay.
[2] Figure withheld to avoid disclosing individual company data; included with "Total."

Gem Stones.—Gem varieties of agate, jasper, quartz, and barite were recovered.

Lime.—Lime was produced at two plants in Greene County and one each in Marion, Newton, and Ste. Genevieve Counties; dead-burned dolomite was produced in St. Francois County. Production was slightly greater than in 1961 but value decreased 1 percent. Quicklime and hydrated lime were used chiefly for chemical and industrial purposes. The iron and steel industries used dead-burned dolomite for refractory purposes. The Southwest Lime Co. plant at Neosho in Newton County was purchased by Ash Grove Lime & Portland Cement Co.; the plant was to be dismantled and customers supplied from the Ash Grove plant in Greene County.

Perlite.—At its plant in St. Louis, J. J. Brouk & Co. processed crude perlite mined in Western States. The expanded perlite was used principally for lightweight aggregate.

Sand and Gravel.—Sand and gravel was produced, chiefly from stream deposits, in 63 counties. Nearly 87 percent of total production was used for building and highway construction. Industrial sand, produced in Franklin, Jasper, Jefferson, St. Charles, and St. Louis Counties, comprised 8 percent of total tonnage and 26 percent of total value. Commercial operations furnished 92 percent of the total tonnage and 94 percent of the total value; the remainder was Government-and-contractor output. More than 98 percent of the commercial sand and gravel was processed. Shipments of commercial production were 68 percent by truck, 22 percent by rail, and 10 percent by water or other methods.

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TABLE 7.—Lime sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quicklime	Hydrated lime	Total lime	
			Quantity	Value
1953–57 (average)	1,118	217	1,335	$13,989
1958	953	220	1,173	14,136
1959	1,089	235	1,324	15,714
1960	1,030	224	1,254	14,701
1961	958	215	1,173	13,873
1962	(1)	(1)	1,176	13,703

[1] Figure withheld to avoid disclosing individual company data; included with "Total lime."

TABLE 8.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		To	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	7,493	$7,998	1,254	$898	8,747	$8,896
1958	8,281	9,285	691	443	8,972	9,728
1959	9,573	10,959	706	447	10,279	11,406
1960	9,631	11,194	576	407	10,207	11,601
1961	8,744	10,266	627	422	9,371	10,688
1962	9,445	10,927	859	645	10,304	11,572

TABLE 9.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,062	$2,737	3,307	$2,909
Paving	1,040	916	1,143	943
Fill	305	249	321	290
Industrial glass	386	1,017	419	1,064
Other [1]	459	1,751	546	2,008
Total	5,252	6,670	5,736	7,214
Gravel:				
Building	1,957	2,430	1,908	2,203
Paving	1,405	1,078	1,702	1,440
Fill	40	27	16	11
Other [2]	90	61	83	59
Total	3,492	3,596	3,709	3,713
Total sand and gravel	8,744	10,266	9,445	10,927
Government-and-contractor operations:				
Sand: Paving	25	25	57	57
Gravel: Paving	602	397	802	588
Total sand and gravel	627	422	859	645
Grand total	9,371	10,688	10,304	11,572

[1] Includes molding, filtering, railroad ballast, and other construction, industrial, and ground sand.
[2] Includes railroad ballast and miscellaneous gravel.

TABLE 10.—Sand and gravel production in 1962, by counties

County	Short tons	Value	County	Short tons	Value
Bates	1,241	$827	Miller	74,667	$70,093
Benton	17,190	13,396	Moniteau	15,574	12,238
Butler	21,623	13,655	Monroe	32,986	26,731
Camden	18,416	14,826	Montgomery	110,827	100,721
Carter	3,750	2,400	Morgan	32,720	25,367
Christian	11,048	7,070	Nodaway	36,500	35,000
Cole	90,692	89,154	Oregon	9,939	6,361
Crawford	22,648	15,412	Osage	14,597	13,719
Dallas	6,548	4,830	Ozark	15,126	12,861
Daviess	22,275	22,275	Pemiscot	360,591	356,157
Dent	9,000	6,246	Phelps	27,289	24,039
Douglas	263,851	165,108	Pike	12,319	9,362
Dunklin	100,000	100,000	Polk	19,600	21,000
Franklin	482,657	539,769	Reynolds	18,125	11,600
Gasconade	7,885	5,932	St. Louis	4,484,891	5,332,372
Howard	60,070	54,063	Ste. Genevieve	17,261	21,229
Howell	4,153	2,658	Shannon	7,504	4,802
Jefferson	451,375	898,955	Stoddard	268,528	229,084
Laclede	11,256	8,313	Taney	5,688	7,640
Lafayette	123,913	126,110	Vernon	4,500	1,800
Lawrence	12,398	8,754	Warren	44,044	39,642
Lincoln	115,663	120,928	Wright	14,878	9,522
Livingston	62,321	60,215	Other counties [1]	2,738,808	2,907,807
McDonald	7,740	4,954			
Maries	9,411	7,453	Total	10,304,086	11,572,450

[1] Includes Barry, Boone, Buchanan, Cape Girardeau, Cooper, Gentry, Jackson, Jasper, Lewis, Perry, Pulaski, Ralls, St. Charles, Texas, Washington, and Wayne Counties, combined to avoid disclosing individual company confidential data. Undistributed amounts from various counties are also included.

Stone.—Limestone, granite, marble, sandstone, and miscellaneous stone were quarried. Limestone production from 77 counties supplied 97 percent of the total tonnage and 93 percent of the total value. Crushed and dimension granite were produced in Iron County. Dimension marble was produced in Jasper, Greene, and Ste. Genevieve Counties; crushed marble was produced in Jasper, Jefferson, and Madison Counties. Dimension sandstone was quarried in Shannon and Vernon Counties; crushed sandstone was produced in Saline and Andrews Counties. Miscellaneous stone (chats) was produced in St. Francois and Jasper Counties. Principal uses for crushed stone were

TABLE 11.—Stone sold or used by producers, by kinds

Year	Granite		Marble		Limestone	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1958	3,648	$260	(1)	(1)	23,387,507	$30,774
1959	3,111	276	181,070	$1,704	25,980,397	33,944
1960	3,806	233	148,930	1,737	26,410,534	35,475
1961	4,532	295	139,477	2,125	24,852,463	33,716
1962	4,452	286	(1)	(1)	27,900,975	40,889

Year	Sandstone		Miscellaneous stone [2]		Total stone	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1958	(1)	(1)	870,879	$465	24,275,550	$32,878
1959	5,209	$83	769,553	428	26,939,340	36,435
1960	2,811	42	614,287	391	27,180,368	37,878
1961	2,948	42	631,250	399	25,630,670	36,577
1962	[3] 2,943	38	495,226	345	28,876,422	44,006

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Total stone."
[2] Chats; also includes small quantity of other stone.
[3] Excludes crushed sandstone; included with "Total stone."

concrete aggregate, roadstone, riprap and agricultural stone; dimension stone was used for monuments and building purposes. Commercial producers supplied 98 percent of total stone output.

Asphaltic sandstone for road surfacing was produced in Barton County by Bar-Co Roc Asphalt Co.

Roofing Granules.—No action was taken by The Ruberoid Co. on its previously announced proposal to mine, mill, color, and store granules in Iron County.

Tripoli.—Tripoli was processed from Oklahoma ore by American Tripoli Division of The Carborundum Co. at its Seneca plant in Newton County. Production was greater than in 1961.

Vermiculite.—Crude vermiculite from Western States was exfoliated at plants in St. Louis and Jackson Counties. Output was slightly less than in 1961.

METALS

Mine Mills and Smelters.—St. Joseph Lead Co. operated its Viburnum mill in Iron County, Indian Creek mill in Washington County, and Federal and Leadwood mills in St. Francois County until they were closed by a strike on July 27, 1962. The company's Herculaneum lead smelter continued operating two furnaces until October 8; smelter operations were then suspended due to lack of concentrates.

Columbium-Tantalum.—Potassium tantalum fluoride was produced from imported ores by Mallinckrodt Nuclear Corp., a subsidiary of Mallinckrodt Chemical Works, at its St. Louis plant.

Copper.—Copper was recovered from lead-copper ore and lead ore mined in the lead belt. Copper output was larger than in 1961.

Universal Minerals and Metals, Inc., purchased the metals refinery at Fredericktown from Perry Equipment Co.

Iron Ore.—Meramec Mining Co., owned jointly by Bethlehem Steel Co. and St. Joseph Lead Co., continued developing its Pea Ridge iron ore project. According to the St. Joseph Lead Co. annual report, about 30 percent of the underground development work necessary to bring the mine into production had been completed at yearend. Capacity would be 12,000 tons of ore per day.

Brown ore (limonite) and hematite ore were produced from 11 mines in 4 counties; reported average iron content of concentrates produced from the ores was 52.5 percent. Compared with 1961 data, output increased 2 percent in quantity and decreased 12 percent in value.

Iron and Steel.—The Sheffield Steel Division of Armco Steel Corp. operated its rod mill, bar joist plant, and its open hearth and electric furnaces in Jackson County. Foundries used iron and steel scrap and pig iron to make castings, principally in the St. Louis and Kansas City areas.

Lead.—Mine production of recoverable lead totaled 60,982 tons—a considerable decrease from that of 1961, because of labor problems which halted production from July 27 until yearend. St. Joseph Lead Co. placed shaft No. 28 of the Viburnum mine in Iron County on a production basis on January 1. The capacity of the Viburnum mill was increased to 6,000 tons of ore per day. The price of lead was 10.25 cents per pound (New York) from January 1 through January 4, 10 cents from January 5 through January 31, 9.75 cents from February 1 through February 8, 9.50 cents from February 9 through No-

vember 1, and 10 cents from November 2 through December 31. This was the first time since 1946 that the price of lead dropped below 10 cents per pound.

TABLE 12.—Iron and steel scrap and pig iron consumption

(Short tons)

Year	Iron and steel scrap	Pig iron	Total scrap and pig iron
1958	896, 231	36, 257	932, 488
1959	843, 155	73, 518	916, 673
1960	827, 811	44, 649	872, 460
1961	869, 002	24, 246	893, 248
1962	864, 994	29, 247	894, 241

TABLE 13.—Mine production of silver, copper, lead, and zinc, in terms of recoverable metals

Year	Mines producing	Material sold or treated		Silver		Copper	
		Crude ore (short tons)	Old tailing (short tons)	Troy ounces	Value (thousands)	Short tons	Value (thousands)
1953–57 (average)		6, 775, 599	1, 420, 722	291, 982	$264	1, 903	$1, 271
1958	9	5, 945, 836	479, 916	250, 917	227	1, 429	752
1959	4	5, 573, 517		339, 760	308	1, 065	654
1960	5	5, 897, 813		15, 594	14	1, 087	698
1961	7	5, 242, 779		11, 793	11	1, 479	887
1962	6	2, 991, 463		490, 896	533	2, 752	1, 695

Year	Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	125, 337	$35, 936	5, 400	$1, 281	$38, 752
1958	113, 123	26, 471	362	74	27, 524
1959	105, 165	24, 188	92	21	25, 171
1960	111, 948	26, 196	2, 821	728	27, 636
1961	98, 785	20, 350	5, 847	1, 345	22, 593
1962	60, 982	11, 221	2, 792	642	14, 091

TABLE 14.—Mine production of lead and zinc in southeastern and central Missouri, in terms of concentrates and recoverable metals[1]

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Recoverable metal content[2]			
					Lead		Zinc	
	Short tons	Value[3] (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1953–57 (average)	179, 583	$30, 701	6, 266	$504	125, 104	$35, 870	3, 299	$793
1958	159, 068	23, 015	770	41	113, 123	26, 471	362	74
1959	146, 765	21, 698	206	12	105, 165	24, 188	92	21
1960	155, 781	23, 105	5, 602	446	111, 948	26, 196	2, 821	728
1961	137, 862	18, 720	11, 024	973	98, 785	20, 350	5, 847	1, 345
1962	83, 897	10, 620	5, 135	492	60, 982	11, 221	2, 792	642

[1] Based on southeastern and central Missouri ore "dirt" and old tailing treated at mills.
[2] In calculating metal content of ores from assays, allowance has been made for smelting losses. In comparing values of concentrate "ore" and metal, value for concentrate is that received by producer, whereas value of lead and zinc is calculated from average price for all grades.
[3] Values are arbitrary, because part of lead concentrate is smelted by producer.

TABLE 15.—Tenor of lead and zinc ore milled and concentrates produced in southeastern Missouri

		Southeastern Missouri	
		1961	1962
Concentrate production:			
Lead	short tons	137,862	83,897
Zinc	do	11,024	5,135
Concentrate obtained from:			
Lead	percent	2.63	2.80
Zinc	do	0.21	0.17
Metal content of ore: [1]			
Lead	do	1.88	2.04
Zinc	do	0.11	0.09
Average lead content of galena concentrate	do	73.12	74.17
Average zinc content of sphalerite concentrate	do	58.94	60.43
Average value per ton:			
Galena concentrate		$135.79	$126.58
Sphalerite concentrate		$88.24	$95.82
Total material milled	short tons	5,242,779	2,991,463

[1] Figures represent metal content of crude ore only as recovered in the concentrate; data on tailing losses not available.

Silicon.—Monsanto Chemical Co. produced ultrapure silicon metal for electronics use at its plant near St. Charles in St. Charles County. Mallinckrodt Chemical Works produced metallurgical-grade silicon metal and high-purity monocrystal silicon at its St. Louis plant.

Silver.—Silver output greatly increased. Principal reasons were (1) the rise in the price of silver because of suspension of sales by the U.S. Treasury from its stocks, (2) the ability to refine pig lead and recover the silver at a net gain, and (3) the smelting of stocked concentrates and pig lead. As a result of these circumstances, 1962 silver recovery totaled 491,000 ounces valued at $533,000, compared with 12,000 ounces valued at $11,000 in 1961.

Uranium.—Uranium oxide and enriched uranium metal were produced near St. Louis by the chemical division of United Nuclear Corp., formerly Mallinckrodt Nuclear Corp.

Zinc.—Production of zinc dropped considerably, mainly because of the extended strike of the mineworkers. Output was reported from St. Francois and Washington Counties.

TABLE 16.—Mine production of silver, copper, lead, and zinc in 1962, by months, in terms of recoverable metals

Month	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	64,108	94	8,030	420
February	64,771	97	8,114	397
March	70,905	104	8,882	460
April	73,606	109	9,221	403
May	78,422	117	9,824	411
June	71,736	104	8,986	367
July	63,262	197	7,925	334
August		5		
September		5		
October		5		
November	2,043	958		
December	2,043	957		
Total:				
1962	490,896	2,752	60,982	2,792
1961	11,793	1,479	98,785	5,847

No zinc was produced in the southwestern Missouri part of the Tri-State district for the fifth consecutive year. (Details of Tri-State activity are given in the Oklahoma chapter.)

MINERAL FUELS

Coal (Bituminous).—Bituminous coal was mined in 13 counties; output of 1,000 tons or more was reported from 27 mines. Strip-mine production, reported from 18 mines in 11 counties, supplied 98 percent of total tonnage and total value. Overburden excavated in 1962, totaling nearly 51 million cubic yards, averaged nearly 20 cubic yards for each ton of coal produced by strip mines. Nine underground mines in four counties supplied 2 percent of total tonnage and total value. All underground production was cut by machines; 82 percent was power drilled. Nearly 69 percent of the 2.9 million tons of coal mined was mechanically cleaned at 7 cleaning plants in the State and 2 cleaning plants in Kansas; over 28 percent was crushed at 12 mines, and over 2 percent was oil treated at 6 mines.

TABLE 17.—Coal (bituminous) production

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	2,880	$11,712	1960	2,890	$12,450
1958	2,592	11,111	1961	2,938	12,567
1959	2,748	11,937	1962	2,896	12,057

Natural Gas.—Natural gas was produced from the Turney pool in Clinton County. Laclede Gas Co. increased its underground gas storage working capacity in the Florissant field, St. Louis County, to 30.1 million cubic feet.

Petroleum.—Crude petroleum was recovered near St. Louis and near Tarkio in Atchison County. American Oil Co. (Amoco) operated its Sugar Creek refinery near Kansas City in Jackson County. Construction of a 70,000-barrel-per-day crude-oil-distillation unit continued during the year.

Petroleum exploration consisted of 12 dry holes, totaling 17,000 feet, drilled in 10 counties.

REVIEW BY COUNTIES

Mineral production was reported in 104 of the 114 counties; 23 counties reported production valued at $1 million or more. Five counties—St. Louis, St. Francois, Cape Girardeau, Ste. Genevieve, and Jackson—contributed 58 percent of the total mineral production value. No mineral production was reported in Bollinger, Carroll, Chariton, Hickory, Mississippi, New Madrid, Ripley, Schuyler, Scotland, and Webster Counties.

Only those counties with significant production are discussed below; see table 18 for additional details.

Adair.—Coal was mined underground by Billy Creek Coal Co., Inc., and Blacksmith Coal Co., Inc. Bailey Limestone Co. and Rash Rock & Limestone Co. quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone (agstone), and riprap.

Atchison.—Petroleum was recovered near Tarkio.

Audrain.—The county ranked first in clay production. Kaiser Refractories & Chemicals, A.P. Green Fire Brick Co., Wellsville Fire Brick Co., Walsh Refractories Corp., North American Refractories Co., General Refractories, and Refractories Division, H. K. Porter Co., Inc., used fire clay from the county to manufacture refractories. Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Molino Lime Co.

TABLE 18.—Value of mineral production in Missouri, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value
Adair	$273,971	$258,174	Coal, stone.
Andrew	213,501	(2)	Stone.
Atchison	(2)	(2)	Petroleum.
Audrain	1,051,308	1,332,225	Clays, stone.
Barry	50,526	(2)	Stone, sand and gravel.
Barton	(2)	(2)	Coal, stone, asphaltic sandstone.
Bates	(2)	(2)	Stone, sand and gravel.
Benton	(2)	13,996	Sand and gravel, gem stones.
Boone	888,001	1,541,409	Stone, coal, sand and gravel, clays.
Buchanan	280,435	354,156	Sand and gravel, stone.
Butler	37,249	13,882	Sand and gravel, clays.
Caldwell	187,881	219,297	Stone.
Callaway	1,530,361	1,490,721	Stone, clays, coal.
Camden	(2)	14,826	Sand and gravel.
Cape Girardeau	[3] 13,071,199	13,722,234	Cement, stone, clays, sand and gravel.
Carter	----------	2,400	Sand and gravel.
Cass	254,017	274,646	Stone, clays.
Cedar	56,245	35,836	Stone.
Christian	----------	7,070	Sand and gravel.
Clark	344,275	432,473	Stone, coal.
Clay	1,130,921	1,102,267	Stone.
Clinton	122,666	166,066	Stone, natural gas.
Cole	286,539	89,154	Sand and gravel.
Cooper	292,820	430,253	Stone, sand and gravel.
Crawford	3,423,144	2,404,052	Lead, silver, copper, clays, sand and gravel.
Dade	166,617	247,500	Stone, coal.
Dallas	5,591	4,830	Sand and gravel.
Daviess	207,875	236,209	Stone, sand and gravel.
De Kalb	166,153	159,002	Stone.
Dent	6,575	6,246	Sand and gravel.
Douglas	126,778	165,108	Do.
Dunklin	(2)	100,000	Do.
Franklin	1,152,826	964,228	Sand and gravel, stone, clays.
Gasconade	1,248,350	1,081,593	Clays, stone, sand and gravel.
Gentry	(2)	(2)	Stone, sand and gravel.
Greene	3,387,660	(2)	Stone, lime.
Grundy	(2)	175,012	Stone.
Harrison	159,900	277,588	Do.
Henry	5,269,427	4,765,479	Coal, stone.
Holt	----------	5,140	Stone.
Howard	51,138	391,563	Stone, sand and gravel.
Howell	299,907	639,928	Iron ore, stone, sand and gravel.
Iron	543,161	2,290,808	Lead, stone, silver, copper.
Jackson	[3] 10,468,061	10,877,699	Cement, stone, sand and gravel, clays.
Jasper	2,983,854	2,501,332	Stone, sand and gravel.
Jefferson	1,226,680	1,303,507	Sand and gravel, stone.
Johnson	582,637	182,940	Stone.
Knox	(2)	(2)	Do.
Laclede	19,606	8,313	Sand and gravel.
Lafayette	324,560	514,250	Stone, sand and gravel, coal.
Lawrence	253,691	13,329	Sand and gravel, stone.
Lewis	(2)	(2)	Stone, sand and gravel.
Lincoln	114,354	218,087	Sand and gravel, stone.
Linn	159,313	222,401	Stone.
Livingston	297,503	326,325	Stone, clays, sand and gravel.
Macon	(2)	(2)	Coal, stone.
Madison	726,065	(2)	Stone.
Maries	100,456	109,613	Stone, clays, sand and gravel.
Marion	(2)	(2)	Stone, lime.
McDonald	2,086	4,954	Sand and gravel.
Mercer	(2)	(2)	Stone.
Miller	111,890	118,143	Sand and gravel, stone, barite.
Moniteau	84,633	74,788	Stone, sand and gravel.
Monroe	268,509	415,637	Stone, clays, sand and gravel.
Montgomery	597,608	796,806	Do.
Morgan	16,951	25,367	Sand and gravel.
Newton	[3] 472,185	293,039	Lime, stone.

See footnotes at end of table.

TABLE 18.—Value of mineral production in Missouri, by counties [1]—Continued

County	1961	1962	Minerals produced in 1962 in order of value
Nodaway	(2)	(2)	Sand and gravel, stone.
Oregon	277,141	31,141	Stone, sand and gravel.
Osage	(2)	97,439	Clays, sand and gravel.
Ozark	76,973	12,861	Sand and gravel.
Pemiscott	203,500	356,157	Do.
Perry	112,667	258,491	Stone, sand and gravel.
Pettis	(2)	(2)	Stone.
Phelps	201,717	95,018	Stone, sand and gravel, clays, gem stones.
Pike	318,461	400,746	Stone, sand and gravel.
Platte	(2)	(2)	Clays, stone.
Polk	14,205	21,000	Sand and gravel.
Pulaski	203,553	(2)	Do.
Putnam	(2)	440,129	Coal.
Ralls	[3] 6,126,864	6,988,688	Cement, stone, clays, sand and gravel.
Randolph	2,447,940	2,209,916	Coal, stone.
Ray	(2)	(2)	Stone.
Reynolds	3,200	11,600	Sand and gravel.
St. Charles	1,112,055	1,501,183	Stone, sand and gravel.
St. Clair	(2)	(2)	Coal, stone.
St. Francois	[3] 20,373,995	12,758,364	Lead, iron, lime, copper, stone, zinc, silver.
Ste. Genevieve	[3] 13,760,170	17,790,518	Lime, stone, sand and gravel.
St. Louis	32,397,922	33,455,815	Cement, stone, sand and gravel, clays.
Saline	543,310	1,110,476	Stone.
Scott	42,640	3,575	Do.
Shannon	237,660	75,373	Stone, iron ore, sand and gravel.
Shelby	184,507	240,858	Stone.
Stoddard	247,429	229,084	Sand and gravel.
Stone	2,354	3,750	Stone.
Sullivan	(2)	127,629	Do.
Taney	(2)	64,786	Stone, sand and gravel.
Texas	37,291	161,922	Sand and gravel, stone.
Vernon	195,067	372,922	Coal, stone, sand and gravel.
Warren	239,696	348,729	Clays, stone, sand and gravel.
Washington	6,981,014	5,966,051	Barite, lead, silver, copper, sand and gravel, zinc.
Wayne	103,841	163,849	Sand and gravel, stone, iron ore.
Webster	4,144		
Worth	57,137	(2)	Stone.
Wright	64,042	73,839	Stone, sand and gravel.
Undistributed	[3] 9,619,846	14,513,190	
Total	[3] 151,288,000	153,307,000	

[1] Counties not listed because no production was reported in 1961 or 1962: Bollinger, Carroll, Chariton, Hickory, Mississippi, New Madrid, Ripley, Schuyler, and Scotland.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.

Barry.—Limestone was quarried and crushed for concrete aggregate and roadstone by W. J. Menefee Construction Co. and Douthitt Lime Co. Missouri State Highway Department contracted for paving gravel.

Barton.—Clemens Coal Co. strip-mined coal. Bar-Co Roc Asphalt Co. produced asphaltic sandstone for use on roads. John J. Stark quarried and crushed limestone for agstone, concrete aggregate, and roadstone.

Bates.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone, by Alvis Limestone & Concrete Products, Inc., Underwood Quarry, and Kunshek Chat & Coal Co. Paving gravel was produced by Clyde S. Miller.

Benton.—J. C. Orender supplied locally mined gravel for building and paving. Missouri State Highway Department contracted for paving gravel. Varied gem stones were found in the county.

Boone.—Peabody Coal Co. began operating its Mark Twain coal mine near Hinton. Anticipated annual production ranged from 400,000 to 500,000 tons. Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Garrett City Quarry Co.,

Boone Quarries, Inc., and Adrian Materials Co. Building, paving, and fill sand was produced by Columbia Sand Co. Shale and fire clay were mined by Columbia Brick & Tile Co. and used for heavy clay products.

Buchanan.—Pioneer Sand Co. produced building, paving, railroad ballast, and fill sand. Everett Quarries, Inc., and L. S. Stafford quarried and crushed limestone for concrete aggregate, roadstone, agstone, and riprap.

Butler.—Smittle Gravel Co., George Golden, and Grobe & Son produced sand and gravel for building, paving, and other uses. Clay for heavy clay products was mined by A. D. Willis & Son Industries.

Caldwell.—Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by Farmers Rock & Lime, Inc., and Kingston Stone Co.

Callaway.—The county ranked third in value of clay output and sixth in value of coal production. Fire clay for use in refractories was produced by Harbison-Walker Refractories Co.; Kaiser Refractories & Chemicals Division; Walsh Refractories Corp.; Refractories Division, H. K. Porter Co., Inc.; and Clayton & Crowson. Limestone for concrete aggregate, roadstone, agstone, railroad ballast, and riprap was quarried and crushed by Auxvasse Stone & Gravel Co., Mo-Con, Inc., of Fulton, and Sulgrove Mining & Quarry Co. Mariott-Reed Coal Co. announced closure of its strip mine.

Cape Girardeau.—The county ranked second in cement production, sixth in stone output, and third in total value of mineral production. Marquette Cement Manufacturing Co. quarried clay and limestone for portland and masonry cements. The company supplied cement for construction of the navigation lock of Barkley Dam on the Cumberland River in Kentucky. Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agstone by The Federal Materials Co., Inc., Farmers Limestone Co., and Marquette Cement Manufacturing Co. Building and paving sand was produced by Cape Girardeau Sand Co. Kasten Clay Products, Inc., and Ceramo Co., Inc., mined common red clay for brick, pottery, and stoneware.

Cass.—Hackler & Limpus Quarry, Marino & Hoover Contracting Co., Inc., S & W Quarries, and Deitz-Hill Development Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone. United Brick & Tile Co. mined miscellaneous clay for brick and tile.

Cedar.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone near Jerico Springs by Geo. M. Baker Co.

Clark.—Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by Baker Quarry Co. and Brooks Quarry, Inc. Coal was strip-mined by Hamlin Bros. Coal Co.

Clay.—Limestone was quarried and crushed for concrete aggregate, roadstone, and riprap by Midwest Precote Co., Kansas City Quarries Co., J. H. Oldham Stone Co., Everett Quarries, Inc., and the Clay County Highway Department.

Clinton.—Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by Everett Quarries, Inc. Natural gas was produced from the Turney pool.

Cole.—Sand and gravel, obtained from the Osage and Missouri Rivers, was used mainly for building and paving. Producers included Jefferson City Sand Co., Cole County Highway Department, and Missouri State Highway Department.

Cooper.—Hall & Riley Quarries, Castle Bros. Quarry Co., and U.S. Army Corps of Engineers quarried and crushed limestone for concrete aggregate, roadstone, agstone, and riprap. Sand and gravel for paving was obtained by Missouri River Sand & Gravel Co. and Missouri State Highway Department.

Crawford.—St. Joseph Lead Co. mined lead ore through shaft No. 27 of its Viburnum operation; the ore was milled in Iron County. Crawford County ranked second in lead output. American Zinc, Lead & Smelting Co. began acquiring surface rights near Bourbon for a possible concentration plant site in conjunction with its iron ore project. Evaluation of reports by consultants on mining methods and costs, metallurgy, and beneficiation methods to determine the feasibility of the project were in progress. During the current drilling program, the deepest diamond-drilled hole in Missouri was 4,206 feet.

Fire clay for refractories was mined and used by Refractories Division, H. K. Porter Co., Inc. Missouri State Highway Department contracted for paving sand and gravel.

Dade.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Allen Quarries, formerly Lockwood Rock Products. Coal was strip-mined by Tyler & Claypool Coal Co.

Daviess.—Snyder Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Bethany Falls Transit Mixed Concrete Co. obtained sand for building purposes.

De Kalb.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Everett Quarries, Inc., and Howard Construction Co.

Douglas.—Sand and gravel for paving was produced by Welton & Gray Gravel Co., Valentine Supply, and Missouri State Highway Department.

Franklin.—Franklin County ranked fourth in value of sand and gravel produced. Sand and gravel, used chiefly for building and paving, was produced by Meramec Aggregates, Inc., Pacific Pebbles, Inc., St. Louis Material & Supply Co., Washington Sand Co., and Missouri State Highway Department. A small quantity of sand was used for grinding and polishing. Crushed limestone and dolomite were produced for concrete aggregate, roadstone, agstone, and riprap by H. E. McClain, Inc., Geo. P. Dawson, Inc., Oliver L. Taetz, Inc., Edwin Bebermeyer, J. E McKeever, Fennel Brown, and Missouri State Highway Department. Fire clay for use in refractories was mined by Walsh Refractories Corp., Refractories Division, H. K. Porter Co., Inc., Wellsville Fire Brick Co., Thacker & Hoer Mining Co., and Kaiser Refractories & Chemicals Division.

Gasconade.—The county ranked second in clay production. Seven refractories manufacturers used burley, flint, and diaspore fire clays. General Chemical Division of Allied Chemical Corp. mined fire clay for chemical uses. Crushed limestone for riprap was produced by the U.S. Army Corps of Engineers. Missouri State Highway Department contracted for paving gravel.

Gentry.—Paving gravel and crushed limestone for concrete aggregate, roadstone, and agstone were produced by Albany Gravel Co., Inc.

Greene.—The county ranked second in value of lime production and fifth in value of stone production. Ash Grove Lime & Portland Cement Co. quarried limestone and produced lime at its Galloway and

Springfield plants. A rotating circular hearth for burning lime, the first of its kind, was installed by the company at its Galloway plant. Advantages include immediate and positive control of burning temperature, quantity of stone being burned, and length of time in the hearth. Crushed limestone for concrete aggregate, roadstone, agstone, and other uses was produced by Ash Grove Lime & Portland Cement Co., Griesemer Stone Co., Graystone Quarry Co., Concrete Co. of Springfield, and Missouri State Highway Department. Dimension marble was prepared by Carthage Marble Corp. at its quarry.

Grundy.—Jay Wilcox Limestone Quarry Co., E. E. Trenary, and Trager Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, agstone, and riprap.

Harrison.—Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by L. W. Hayes, Inc., Davis-Snyder Quarries, Inc., and E. G. Sargent.

Henry.—Henry County continued to lead in coal production. Coal was strip-mined by Peabody Coal Co., Bud Jones Coal Co., Hoppe Coal Co., and Madole Bros. Coal Co. Williams Rock Mining Co., Inc., Davis Rock Co., and O. A. Knisely quarried and crushed limestone for concrete aggregate, roadstone, agstone, and riprap.

Howard.—Glasgow Quarries, Inc., produced crushed limestone for concrete aggregate, roadstone, and riprap. Building sand was obtained from local deposits by Glasgow Sand Co.

Howell.—Howell County ranked second in iron ore production. Brown iron ore was mined by Shook & Fletcher Supply Co., Plateau Iron Ore Corp., Schroeder Mining Co. of Missouri, and Riggs & Morrison. Missouri State Highway Department contracted for gravel and crushed limestone for use on roads.

Iron.—St. Joseph Lead Co. mined lead ore through shaft No. 28 of its Viburnum operation. The company increased the capacity of its lead mill to 6,000 tons per day. Crushed and dimension granite were produced by Heyward Granite Co.

Jackson.—The county ranked third in value of stone production, fourth in value of cement production, and fifth in total value of mineral production. Crushed limestone was produced at 11 quarries for concrete aggregate, roadstone, and agstone. Leading producers were Beyer Crushed Rock Co., Stewart Sand & Material Co., Union Construction Co., Centropolis Crusher Co., and Blue Valley Crushed Stone Co. Dimension limestone was prepared by Gerald Hodgins Quarry, Charles Rove Stone Quarry, and George & Clark Stone Contractors. Limestone and shale for manufacturing portland and masonry cements were quarried near Independence by Missouri Portland Cement Co. Stewart Sand & Material Co. produced paving sand. United Brick & Tile Co. mined miscellaneous clay for heavy clay products. Vermiculite from Montana was exfoliated by The Zonolite Co. American Oil Co. produced heptene concentrate and sodium cresylate from petroleum fractions at its Sugar Creek petrochemical plant.

Jasper.—The county ranked fourth in value of stone and fifth in value of sand and gravel production. Carthage Marble Corp. quarried marble for us as rough building stone, dressed building stone, and dressed monumental stone; the company also produced crushed stone. Crushed limestone was produced by Carthage Crushed Limestone

Co., Independent Gravel Co., and Nelson Bros. Quarries for concrete aggregate, roadstone, agstone, and other uses. Independent Gravel Co. produced blast sand, grinding and polishing sand, paving gravel, and railroad ballast gravel. American Zinc, Lead and Smelting Co. and Independent Gravel Co. produced miscellaneous stone (chats) for concrete aggregate, roadstone, railroad ballast, and other uses.

Anhydrous and aqua ammonia, nitrogen solutions, coated 45-percent urea, uncoated 46-percent urea, and feed urea were produced by Solar Nitrogen Chemicals Co., using natural gas as raw material. Anhydrous ammonia capacity was being expanded from 300 to 390 tons per day at a cost of $1.3 million. The company is owned jointly by Atlas Powder Co. and Standard Oil Co., and the plant is adjacent to the Atlas explosives plant near Joplin.

Jefferson.—The county retained second place in value of sand and gravel produced. High-purity silica sand, used in plate glass and for molding, grinding, and polishing, was produced by Pittsburgh Plate Glass Co., Manley Sand Division, Martin Marietta Corp., and Masters Bros. Silica Sand Co. Building sand and gravel was produced by Ficken Material Co. Missouri State Highway Department contracted for paving gravel. Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by H. Trautman Quarry, Inc., Kitson Bros. Quarry, Bussen Quarries, Inc., and House Springs Quarry Co. Marble Products Co. of Georgia produced crushed marble for terrazzo and other uses.

Ammonia, nitric acid, ammonium nitrate, and ammonia solutions were produced by Armour Agricultural Chemical Co., Nitrogen Division, at its Crystal City plant, using natural gas as raw material. The Dow Chemical Co. produced polystyrene and styrofoam from styrene at its petrochemical plant near Pevely. Mallinckrodt Nuclear Corp. operated its nuclear fuel production center at Hematite.

St. Joseph Lead Co. operated its Herculaneum lead smelter, utilizing two furnaces until October 8, when smelter operations were suspended owing to lack of concentrates.

Johnson.—Limestone was quarried and crushed by Marr Bros. Quarry and Deitz-Hill Development Co. for concrete aggregate, roadstone, and agstone.

Knox.—McSorley Lime & Rock Co., Inc., and Knox County Stone Co., Inc., quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Lafayette.—Limestone was quarried and crushed by Red Stone Co. and Deitz-Hill Development Co. for riprap, concrete aggregate, and roadstone. Glasgow Sand Co. and Raymond Drivers Sand Co. dredged sand for building and paving. Coal was mined by F. W. Goodloe Coal Co., Jones Coal Co., and Earl Ashford Coal Co.

Lawrence.—Republic Stone Co. produced dimension limestone for rough construction, rough architectural, and other uses. Missouri State Highway Department contracted for paving gravel.

Lewis.—Missouri Gravel Co. produced paving sand and gravel near LaGrange. Missouri Gravel Co. and Hamill Lime Co. quarried and crushed limestone for concrete aggregate, roadstone, agstone, and riprap.

Lincoln.—Building and paving sand and gravel were obtained from local deposits by Kimaterials and Missouri State Highway Department. Limestone was quarried and crushed by Watson Quarry and Lincoln Quarry for concrete aggregate, roadstone, and soil conditioner.

Linn.—Limestone was quarried and crushed by Bailey Limestone Co., Inc., for concrete aggregate, roadstone, and agstone.

Livingston.—Trager Quarries, Inc., Farmers Rock & Lime, Inc., and Fred McVey Quarry produced crushed limestone for concrete aggregate, roadstone, agstone, and riprap. Cooley Gravel Co. and Sampsel Gravel Co. produced building and paving sand and gravel. Midland Brick & Tile Co. mined miscellaneous clay for use in brick and tile.

Macon.—The county ranked third in coal production. Coal was strip-mined by Peabody Coal Co. at its Bee-Veer mine. Limestone was quarried and crushed for concrete aggregate and roadstone by Trager Quarries, Inc.

Madison.—Marble Products Co. of Georgia crushed stone for use as an aggregate in terrazzo. The Madison mine of National Lead Co. remained closed the entire year.

Maries.—Adrian Materials Co. and Smith Quarries produced crushed limestone for concrete aggregate, roadstone, and riprap. Refractories Division, H. K. Porter Co., Inc., and Dillon Bros. mined diaspore, burley, and other fire clays for use in refractories. Missouri State Highway Department contracted for paving gravel.

Marion.—Marblehead Lime Co. quarried limestone near Hannibal for quicklime and hydrated lime; limestone also was produced for asphalt filler and mineral food. S. D. Fessenden & Sons crushed limestone for agstone, concrete aggregate, and roadstone.

Mercer.—Twin State Quarries, Inc., and Wilcox Quarries quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Miller.—Sand and gravel for building, paving, and railroad ballast was produced by C. W. Roweth Co., Elam Construction Co., Inc., and Missouri State Highway Department. Eldon Quarry Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Barite was produced by Kagee Mining Co., Inc.

Mississippi.—Petrolini Corp. of Mt. Sterling, Ill., began leasing land in the county for oil or gas exploration; between 30,000 and 35,000 acres were to be leased.

Moniteau.—Limestone was quarried and crushed by Moniteau County Agricultural Association, Inc., for agstone, concrete aggregate, and roadstone. Missouri State Highway Department contracted for paving gravel.

Monroe.—Central Stone Co., Hamilton Lime Co., and Wilkerson Bros. quarried and crushed limestone for concrete aggregate, roadstone, and soil conditioner. Walsh Refractories Corp. and Christy Firebrick Co. mined and used fire clay for refractories. Gilliam Mining Co. mined fire clay for use in horizontal zinc retorts.

Montgomery.—The county ranked fifth in value of clay output. Fire clay for refractories was mined by four companies. McClain Lime Quarry and Adams & James quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Two Rivers Sand & Gravel Co. and Montgomery County Highway Department produced sand and gravel for building and paving.

Newton.—Southwest Lime Co. was purchased by Ash Grove Lime & Portland Cement Co.; the plant was to be dismantled and Southwest's customers were to be supplied from the Ash Grove plant in Greene County. Before the operation was purchased and shut down, limestone was quarried and used in manufacturing quicklime; crushed limestone was sold for agstone, concrete aggregate, roadstone, and riprap. The American Tripoli Division of The Carborundum Co. processed tripoli for polishing and buffing compounds at its Seneca plant from crude material mined in Ottawa County, Okla.

Nodaway.—Dillon Stone Co. quarried and crushed limestone for concrete aggregate, roadstone, and soil conditioner. Earl Wilson Sand Co. dredged sand and gravel for building, fill, and other uses.

Oregon.—Limestone for agstone, concrete aggregate, and roadstone was quarried and crushed by O. O. Mainprize. Missouri State Highway Department obtained gravel and crushed limestone for paving.

Osage.—Diaspore, burley, and fire clays were mined for A. P. Green Fire Brick Co., Kaiser Refractories and Chemicals Division, and Walsh Refractories Corp. for manufacturing refractories. Osage County Highway Department obtained gravel for paving.

Pemiscot.—Building and paving sand and gravel were obtained from local deposits by Taylor Sand & Gravel Co.

Perry.—Limestone was quarried and crushed for concrete aggregate, roadstone, and riprap by Gibbar Bros., Inc., and the U.S. Army Corps of Engineers. Gibbar Bros., Inc., also produced paving gravel.

Pettis.—Howard Construction Co. and W. J. Menefee Construction Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Phelps.—Bray Construction Co. and Nivens Lime Quarry quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Sand and gravel for building and paving was produced by Grisham Sand & Gravel Co. Missouri State Highway Department contracted for paving gravel. A. P. Green Fire Brick Co. and Dillon Bros. mined fire clay for refractories.

Pike.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Hamill Lime Co., Galloway Limestone Co., and Magnesium Mining Co. Missouri State Highway Department contracted for paving gravel. Hercules Powder Co. produced ammonia, ammonium nitrate, methanol, formaldehyde, and pentaerythritol from natural gas at its petrochemical plant near Louisiana. The company began constructing new facilities to produce urea solutions, urea ammonium nitrate solutions, and prilled ammonium nitrate, expected to go on stream in 1963.

Platte.—Carter-Waters Corp. mined shale for manufacturing lightweight aggregate. Everett Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, and riprap.

Polk.—Butcher Gravel Co. produced paving gravel near Humansville.

Pulaski.—Building sand and gravel and paving gravel were produced by Big Piney Sand Co. Missouri State Highway Department contracted for paving gravel.

Putnam.—Coal was mined underground by W. T. Clark Coal Co. and Henry T. Clark Coal Co. Husted Bros. Coal Co. strip-mined

coal; Kirkville Coal Co. recovered coal by strip-mining and auger-mining methods.

Ralls.—Ralls County ranked third in cement production. Universal Atlas Cement Division produced portland and masonry cements from limestone and shale quarried at its plant near Ilasco. Central Stone Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Paving gravel was obtained locally by Edward B. Cooper.

Randolph.—The county ranked second in value of coal production. Coal was mined underground by D. L. Bradley Coal Co. and Fately Coal Co., and strip-mined by Peabody Coal Co. Limestone was quarried and crushed by N. J. Cooksey Co. and Potter Stone Co. for concrete aggregate, roadstone, and soil conditioner.

Ray.—Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by Steva Stone Co. and Orrick Stone Co.

Reynolds.—Exploration continued on a large scale in the county. Surface drilling centered in the Oates area.

St. Joseph Lead Co. conducted preliminary investigations for a millsite about 6 miles east of Bunker and 2 miles south of West Fork. The mill would process lead ore from the Oates area.

St. Charles.—The county ranked third in production value of sand and gravel. Tavern Rock Sand Co. produced glass, molding, ferrosilicon, and other industrial sands. Missouri State Highway Department contracted for paving gravel. St. Charles Quarry Co., O'Fallon Quarry and Supply Co., Joerling Bros., and Schiermeier Quarry quarried and crushed limestone for concrete aggregate, roadstone, agstone, and riprap. Monsanto Chemical Co. produced ultrapure silicon metal for electronic uses at its plant near St. Charles.

St. Clair.—The county ranked fourth in value of coal production. Coal was strip-mined by Pittsburg & Midway Coal Mining Co. at its Pioneer mine near Appleton City. Limestone was quarried and crushed for concrete aggregate, roadstone, and soil conditioner.

St. Francois.—St. Francois County ranked first in value of lead, iron ore, copper, and zinc; third in value of lime; and fourth in total value of mineral production. Midwest Ore Co. mined iron ore (hematite) underground at its Iron Mountain mine. St. Joseph Lead Co. mined lead ore and operated its Federal and Leadwood mills until July 27 when operations were halted by a labor dispute. Chats from lead and iron ore milling was used mainly for concrete aggregate, roadstone, and railroad ballast; producers included St. Joseph Lead Co. and Trap Rock Material & Engineering Co. Valley Dolomite Corp. produced dead-burned dolomite for refractory uses; crushed dolomite was used as refractory material, agstone, and railroad ballast. St. Joseph Lead Co. produced dolomite for agricultural purposes.

Ste. Genevieve.—The county led in lime and stone production and ranked second in total mineral production value. Limestone was quarried and crushed by Mississippi Lime Co. to produce quicklime and hydrated lime at its plant near Ste. Genevieve. The company sold crushed limestone for glass, whiting, poultry grit, coal-mine rock dust, asphalt filler, flux, agstone, concrete aggregate, and roadstone. Cliffdale Quarry & Manufacturing Co. produced crushed limestone for concrete aggregate and roadstone. Dimension marble was prepared

by Weiler Marble Co. and Tennessee Marble Co. Sand and gravel for building and paving was obtained locally by Ed L. Bauman.

St. Louis.—The county ranked first in cement, sand and gravel, and total mineral production value, and ranked second in value of stone output. Portland and masonry cements were manufactured at Prospect Hill by Missouri Portland Cement Co. and at Lemay by Alpha Portland Cement Co. Dimension and crushed limestone were produced by West Lake Quarry & Material Co. Producers of crushed limestone included Riverview Stone & Material Co., Vigus Quarries, Inc., Rock Hill Quarries Co., Bussen Quarries, Inc., George A. Janssen, Inc., Frank Ruprecht & Sons Quarry & Material Co., and Orth Bros. Quarry. Stone was crushed for concrete aggregate, roadstone, riprap, agstone, and railroad ballast. Sand and gravel for construction, unground industrial sands, and ground sands were produced; leading producers, by value, were Pioneer Silica Products Co., Winter Bros. Material Co., Inc., St. Charles Sand Co., Missouri Aggregates, Inc., and Norman Bros., Inc. Shale for heavy clay products was mined by Alton Brick Co., W. S. Dickey Clay Manufacturing Co., and Hydraulic Press Brick Co. Fire clay was mined by the Refractories Division of H. K. Porter Co., Inc. A small quantity of petroleum was produced.

Calcium phosphate, bisphenol, maleic anhydride, and fumaric acid were produced by Monsanto Chemical Co. The Titanium Division of National Lead Co. produced titanium pigments from ilmenite concentrates. Crude vermiculite from Western States was exfoliated by Zonolite Co. J. J. Brouk & Co. expanded perlite mined in Western States. Crude barite was ground by the De Lore Division of National Lead Co. Petrolite Corp., Tretolite Division, produced oilfield chemicals, corrosion inhibitors, fuel additives, and industrial bactericides at its St. Louis plant, using petroleum hydrocarbons and chemicals as raw materials.

Saline.—Hall & Riley Quarries, W. J. Menefee Construction Co., Gilliam Rock, Inc., Howard Construction Co., and Missouri State Highway Department produced crushed limestone for concrete aggregate, roadstone, agstone, and riprap.

Shannon.—The county ranked fourth in iron ore production. Brown iron ore was mined by various producers. Ozark Stone Products, Inc., and Salem Stone Co. prepared dimension sandstone. Limestone was quarried and crushed for use as soil conditioner by Crider Bros. Lime Co. Missouri State Highway Department contracted for paving gravel.

Bear Creek Mining Co. announced discovery of a lead deposit about 12 miles from Eminence. Bear Creek Mining Co. and Ozark Lead Co., subsidiaries of Kennecott Copper Corp., held options on land in the county.

Shelby.—Central Stone Co. and Turner Lime & Rock Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Stoddard.—Sand and gravel for building and paving was produced by Brown Sand & Gravel Co., Inc., Hill & Stuart, Inc., and Warren Gravel Co.

Stone.—Limestone was quarried and crushed for concrete aggregate and roadstone by James Mason.

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Sullivan.—Howard Construction Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Taney.—Limestone was quarried and crushed by Poulin & Son Rock & Lime Co. for agstone, concrete aggregate, and roadstone. Missouri State Highway Department and the U.S. Army Corps of Engineers obtained paving gravel from local deposits.

Texas.—Long Bros. quarried and crushed limestone for use as soil conditioner. Missouri State Highway Department contracted for paving sand and gravel.

Vernon.—M. L. Schooley Coal & Construction Co., Ellis Coal Co., Garrett Coal Co., and K & M Coal Co., strip mined coal. George M. Baker Co., Jones Coal & Rock Co., and Alvis Limestone & Concrete Products, Inc., quarried and crushed limestone for concrete aggregate and roadstone. Dressed and rough dimension sandstone were produced by Missouri Native Stone Corp. and Gayer & Deline Stone Co. Paving gravel for road maintenance was produced by Osage Township.

Warren.—Harbison-Walker Refractories Co., Kaiser Refractories and Chemicals Division, and Wellsville Fire Brick Co. mined fire clay for refractories. Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Sprick Quarry. The U.S. Army Corps of Engineers obtained crushed limestone for riprap. Gravel for paving was obtained by Missouri State Highway Department and St. Charles County Highway Department.

Washington.—Washington County ranked first in barite production, reported from 16 operations by 11 companies. Leading producers were Milwhite Mud Sales Co.; Midwest Mining Co.; Magnet Cove Barium Corp.; De Soto Mining Co.; and Baroid Division, National Lead Co. Building and paving sand, paving gravel, and railroad ballast gravel were produced by Mount Sand & Gravel Co. and Midwest Mining Co. Lead ore was mined and milled by St. Joseph Lead Co. at its Indian Creek plant. Lead also was recovered in mining and washing barite. Development of the Pea Ridge iron-ore deposit was continued by Meramec Mining Co. St. Joseph Lead Co. began sinking shaft No. 29 at the Viburnum lead operation.

Wayne.—Building sand and gravel and railroad ballast gravel were produced by Williamsville Stone Co. Missouri State Highway Department contracted for paving gravel. Harris Lime Co. quarried and crushed limestone for soil conditioner. Brown iron ore was mined by various producers and shipped to steel mills.

Worth.—Grand River Quarries, Inc., and Howard Construction Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Wright.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by W. H. Bennett Quarries, Inc. Missouri State Highway Department contracted for gravel and crushed limestone for paving.

The Mineral Industry of Montana

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Montana Bureau of Mines and Geology, for collecting information on all minerals except fuels.

By Frank B. Fulkerson,[1] A. J. Kauffman, Jr.,[2] and Richard W. Knostman [3]

MINERAL production value in Montana in 1962 was the third highest on record. The $190.7 million produced from mines, pits, quarries, and wells in the State was exceeded only in 1956 ($213.8 million) and 1957 ($191.7 million). The advance of $6.4 million over that of 1961 was the result of greater production of crude petroleum, sand and gravel, zinc, and silver. These gains more than offset the lower output of copper caused by a strike at Butte and the loss resulting from the termination of chromite mining at the Mouat mine in Stillwater County.

Output of crude petroleum continued to increase. Petroleum was the leading mineral product in Montana in terms of value. The rise in sand and gravel production was attributed to increased highway construction. Greater zinc and silver production resulted from the start of production from the Elm Orlu-Black rock block caving project at Butte; no zinc ore had been mined at Butte in 1961. The increased price of silver was a factor in the higher annual value of that commodity.

Crude petroleum, copper, and sand and gravel supplied 80 percent of the annual value of mineral production in Montana in 1962. Silver Bow County (mainly copper, zinc, and silver) and Fallon County (petroleum and natural gas) furnished 47 percent of the State total. The production-quantity index increased 1 point, from 123 to 124 (1959=100).

The Anaconda Company began building a 42,000-ton-per-day copper-ore concentrator next to the Berkeley pit at Butte. The new plant, part of which was scheduled to begin operating late in 1963, would eliminate rail transportation of crude ore from Butte to the concentrator at Anaconda, Deer Lodge County.

Work began on the Permanente Cement Co. plant near Helena. Completion of the $9.6 million facility was expected early in 1963, and thereafter shipments of cement were to begin for constructing the Yellowtail Dam on the Big Horn River.

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TABLE 1.—Mineral production in Montana[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Chromium ore and concentrate[2]—short tons, gross weight	82,258	$2,939	-------	-------
Clays[3]—thousand short tons	55	76	56	$77
Coal (bituminous and lignite)—do	371	1,207	382	1,140
Copper (recoverable content of ores, etc.)—short tons	104,000	62,400	94,021	57,917
Fluorspar—do	14,905	(4)	(4)	(4)
Gold (recoverable content of ores, etc.)—troy ounces	35,377	1,238	24,387	854
Iron ore (usable)—thousand long tons, gross weight	34	209	9	62
Lead (recoverable content of ores, etc.)—short tons	2,643	544	6,121	1,126
Lime—thousand short tons	118	986	104	1,049
Manganese ore and concentrate (35 percent or more Mn) short tons, gross weight	17,515	[5] 1,372	24,758	(4)
Manganiferous ore and concentrate (5 to 35 percent Mn)—do	2,236	33	2,264	29
Natural gas—million cubic feet	33,901[r]	2,509	29,955	2,217
Peat—short tons	7,385	112	(4)	(4)
Petroleum (crude)—thousand 42-gallon barrels	30,906	74,793	[6] 31,648	[6] 76,690
Sand and gravel—thousand short tons	14,702	13,506	18,473	17,642
Silver (recoverable content of ores, etc.)—thousand troy ounces	3,490	3,227	4,561	4,948
Stone—thousand short tons	1,512	1,849	996	1,708
Uranium ore—short tons	729	10	(4)	(4)
Zinc (recoverable content of ores, etc.)—do	10,262	2,360	37,678	8,666
Value of items that cannot be disclosed: Barite, cement, gem stones, gypsum, mica, natural gas liquids, phosphate rock, talc, thorite concentrate (1962), tungsten, vermiculite and values indicated by footnote 4	-------	[5] 14,863	-------	16,531
Total	-------	[5] 184,233	-------	190,656

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes tonnage used for ferrochromium production; included with "Value of items that cannot be disclosed."
[3] Excludes fire clay; included with "Value of items that cannot be disclosed."
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Revised figure.
[6] Preliminary figure.

Consumption, Trade, and Markets.—Demand for construction materials, such as sand and gravel and cement, increased owing to the impact of several large projects, including record highway construction, dams near Hardin and Dillon, and missile base construction. The $45 million total of contracts awarded by the Montana Highway Commission in 1962 included $23.7 for interstate highways, $9.8 for primary highways, and $7.9 million for secondary roads.

Personal income in Montana increased 17 percent as the result of higher farm income following a 1961 decrease in farm marketings, the result of a drought.

Employment.—In nonagricultural industries, average employment rose 2 percent. Average monthly employment in metal mining and primary metals processing decreased owing to a strike in the Montana copper-mining industry. Small gains in employment were recorded in the production and refining of petroleum. Average employment in the construction industry advanced 6 percent.

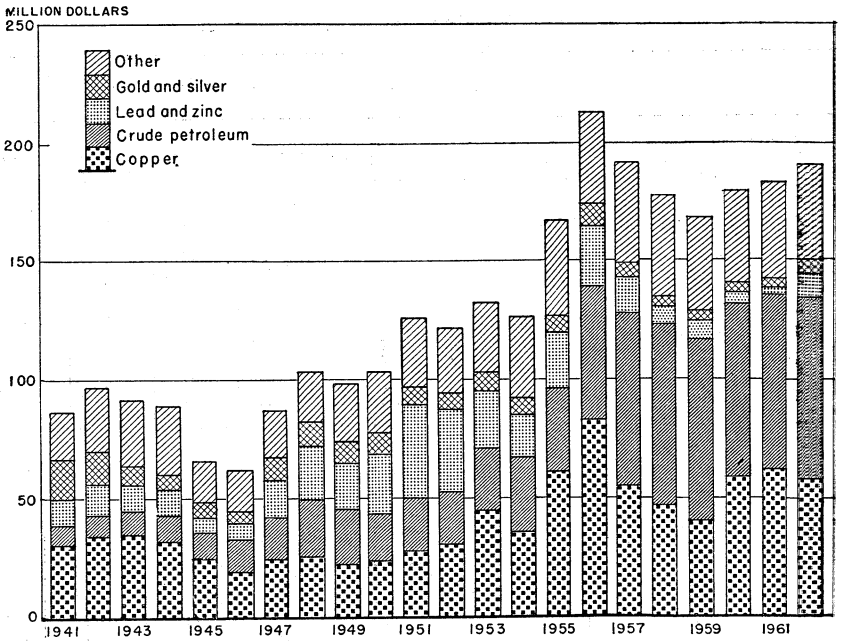

FIGURE 1.—Value of copper, crude petroleum, lead and zinc, gold and silver, and total value of mineral production in Montana, 1941–62.

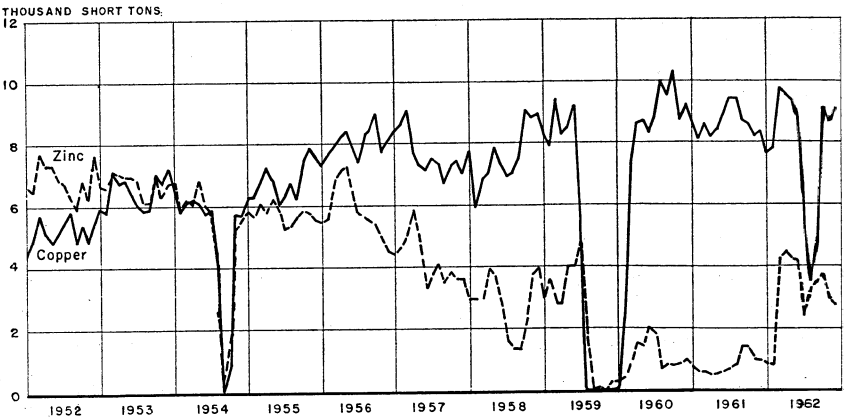

FIGURE 2.—Mine production of copper and zinc in Montana, 1952–62, by months, in terms of recoverable metals.

TABLE 2.—Indicators of Montana business activity

		1961	1962[1]	Change, percent
Personal income:				
Total	million dollars	1,339.0	1,572.0	+17.4
Per capita	dollars	1,963.0	2,217.0	+12.9
Construction activity:				
Building permits	million dollars	33.9	29.9	−11.8
Heavy engineering awards	do.	178.5	71.0	−60.2
Highway construction contracts awarded	do.	42.6	45.0	+5.6
Cement shipments to and within Montana	thousand 376-pound barrels	1,085.3	1,291.5	+19.0
Cash receipts from farm marketings	million dollars	365.3	428.2	+17.2
Mineral production	do.	184.3	190.7	+3.5
Annual average employment:				
Total nonagricultural industries	thousands	166.2	170.0	+2.3
Total manufacturing	do.	20.2	22.0	+8.9
Lumber and timber industries	do.	7.3	8.0	+10.0
Metal-mining and primary-metal industries	do.	7.8	7.4	−5.1
Contract construction	do.	11.6	12.3	+6.0
Transportation and utilities	do.	18.3	18.0	−1.6

[1] Preliminary figures.

Source: Survey of Current Business, Construction Review, Pacific Builder & Engineer, Montana Highway Commission, The Farm Income Situation, Montana Labor Market, and Bureau of Mines.

TABLE 3.—Employment for selected mineral industries

Year	Total mining	Metal mining	Nonmetals, including coal	Petroleum and natural gas	Processing	
					Primary metals	Petroleum refining
1953–57 (average)	11,600	8,000	1,000	2,600	4,140	1,200
1958	8,700	5,300	700	2,700	4,200	1,000
1959	7,800	4,600	700	2,500	3,100	900
1960	7,400	4,500	700	2,200	3,800	900
1961	7,100	4,200	700	2,200	3,600	1,000
1962	6,900	3,900	700	2,300	3,500	1,100

Source: Montana State Employment Service, Montana Labor Market. Excludes proprietors and self-employed. Industry groups may vary from those in the Bureau of Mines canvass.

TABLE 4.—Hours and earnings data in mining and related industries

Industry	1958	1959	1960	1961	1962
Mining:					
Average weekly earnings	$97.42	$101.91	$103.74	$108.14	$111.24
Average weekly hours	39.6	40.6	39.9	40.2	41.2
Average hourly earnings	$2.46	$2.51	$2.60	$2.69	$2.70
Metal mining:					
Average weekly earnings	$93.56	(1)	$101.79	$106.52	$107.25
Average weekly hours	38.5	(1)	39.0	39.6	39.0
Average hourly earnings	$2.43	(1)	$2.61	$2.69	$2.75
Primary-metals processing:					
Average weekly earnings	$91.57	(1)	$96.53	$102.40	$102.82
Average weekly hours	39.3	(1)	39.4	40.0	39.7
Average hourly earnings	$2.33	(1)	$2.45	$2.56	$2.59

[1] Strike in metal-mining industry beginning Aug. 19, 1959, unsettled at yearend.

Source: Montana State Employment Service, Montana Labor Market. Hours and earnings data exclude administrative and salaried personnel. Average weekly and hourly earnings include overtime and other premium pay.

Government Programs.—Two new contracts were active under the program of the Office of Minerals Exploration (OME), U.S. Department of the Interior. These involved work at gold-silver claims in Phillips County by Northern Continental, Inc., and at silver-lead-

zinc properties in Granite County by Trout Mining Co. The costs were $76,100 and $77,610, respectively, with Government participation of 50 percent. Also active was a contract approved in 1960 for lead-zinc exploration in Broadwater County by Northern Milling Co., Inc.

TABLE 5.—Employers, wage earners, and wages in mining

Fiscal year	Average number of employers	Average number of wage earners	Wages (thousands)	Average annual wage
1953–57 (average)	525	11,593	$57,324	$4,945
1958	448	9,019	48,503	5,378
1959	416	8,722	46,017	5,276
1960	492	6,641	36,031	5,426
1961	480	7,453	44,092	5,916
1962	464	6,882	41,800	6,075

Source: Unemployment Compensation Commission of Montana, Montana Labor Market. Industries and employment covered under unemployment insurance laws of Montana.

TABLE 6.—Employment and injuries in the mineral industries

Year and industry	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:						
Quarries and mills [1 2]	221	257	455,127		5	11
Nonmetal mines and mills	713	210	1,198,661		33	28
Sand and gravel operations [2]	276	164	361,077		14	39
Metal mines and mills	3,470	279	7,753,392	3	187	25
Coal mines	159	145	179,560	1	12	72
Total	4,839	257	9,947,817	4	251	26
1962: [3]						
Quarries and mills [1 2]	221	214	378,921		5	13
Nonmetals mines and mills	627	234	1,175,849		33	28
Sand and gravel operations [2]	256	135	276,729	1	6	25
Metal mines and mills	3,805	250	7,616,509	5	176	24
Coal mines	130	130	135,465		4	30
Total	5,039	238	9,583,473	6	224	24

[1] Includes cement- and lime-processing plants.
[2] Includes only commercial operations.
[3] Preliminary figures.

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—The Anaconda Aluminum Co. operated its Columbia Falls primary aluminum plant at capacity (approximateliy 65,000 tons annually) throughout the year. This was the first full year of capacity production since operations began in 1955. Wire and sheet ingots for fabrication and casting ingots for use by foundries were the major products. Wire ingots were shipped to the Anaconda Wire & Cable Co. plant at Great Falls, and sheet ingots were sent to a company sheet-rolling plant at Terre Haute, Ind.

The Anaconda Company reactivated an experimental metallurgical pilot plant at Anaconda, Deer Lodge County, to extract alumina from clay mined from deposits near Moscow, Idaho. Approximately 5 tons of alumina per day was produced at the plant.

A study of the Pacific Northwest aluminum industry was published by the Bureau of Mines.[4]

Chromite.—No chromite was produced. American Chrome Co. stopped production in 1961 following the completion of a Federal stockpiling contract. The company had planned to build a $7 million, 100-ton-per-day, ferrochromium smelter on optioned property near Butte, provided a proposed barter program would be acceptable to the Government. The barter proposal, under which American Chrome would smelt 900,000 tons of stockpiled chromite concentrate for the Government and receive payment in surplus agricultural commodities for disposal overseas, was not accepted by the Government. At midyear, the property option was dropped.

Ferrochromium produced in the company pilot smelter before it shut down in 1961 was shipped to eastern steel plants until stocks were exhausted.

Pyrometallurgical beneficiation of chromite from the Mouat mine of American Chrome Co. and production of ferrochromium were described.[5]

A study of the Pacific Northwest ferroalloy industry was completed by the Bureau of Mines.[6]

Copper.—Output of copper was 10 percent below the 1961 total. As in previous years, more than 99 percent of the output was from The Anaconda Company mines in the Summit Valley (Butte) district, Silver Bow County. The production drop was the result of a strike by Teamsters Union Local No. 2 which idled the Berkeley pit operation from July 16 until September 21. All company mining operations in the Butte area were halted from July 24 to August 2, and from September 17 to 21.

The Berkeley pit yielded 46,686 tons of copper, a 7-percent decline from its 1961 output. Production of ore from the Berkely pit averaged 35,128 tons per operating day, compared with 31,310 tons in 1961. The stripping ratio was 2.91 tons of waste for each ton of ore mined. Output from the Kelley mine dropped 40 percent to 9,808 tons because of a decision to terminate block caving as soon as all existing production blocks were mined to completion. Most of the Kelley ore in the upper levels was to be mined by open-pit methods. Production from the Butte Hill mines (Mountain Con, Steward, and Leonard) increased slightly over the 1961 output. Nearly 2,407 tons of copper was recovered from water pumped from Butte mines through the High Ore shaft to the precipitation plant.

Construction of a 42,000-ton-per-day concentrator adjacent to the Berkeley pit was started. The new plant was to eliminate the haulage of copper ore from Butte to the concentrator at Anaconda, Deer Lodge County. Part of the concentrator was scheduled to begin operating in the third quarter of 1963, and completion of the entire plant was planned for early in 1964. Water for the operation was to be obtained through a 34-inch pipeline being constructed from the

[4] Fulkerson, Frank B. Trends and Outlook in the Pacific Northwest Aluminum Industry. BuMines Inf. Circ. 8046, 1962, 42 pp.

[5] Hunter, Willard L., and Lloyd H. Banning. Pyrometallurgical Beneficiation of Off-grade Chromite and Production of Ferrochromium. BuMines Rept. of Inv. 6010, 1962, 16 pp.

[6] Kingston, Gary A. The Pacific Northwest Ferroalloy Industry. BuMines Inf., Circ. 8050, 1962, 26 pp.

Anaconda Reduction Works at Anaconda to the plant site. The pipe was to be capable of transporting 18 million gallons of water daily. Another 24 million gallons per day was to be recovered from thickeners and from the tailings pond.

Gold.—Production of gold declined 31 percent (10,990 ounces) from the 1961 total. Five placer mines were operated, compared with 17 in 1961, and placer output was 110 ounces—22 ounces less than in 1961. The Anaconda Company mines in the Summit Valley district accounted for 73 percent of the total. The largest gold-producing mine was the Berkeley pit (9,933 ounces); followed by the Kelley (3,447 ounces), Badger State (2,616 ounces), and the Butte Hill mines (1,641 ounces). The strike at operations of The Anaconda Company was an important factor in the decline, because much of the State output was a byproduct of copper production.

The Mayflower and West Mayflower property, Madison County, one of the top 25 domestic gold-producing mines from 1959 to 1961, was idle. The property had been leased previously from The Anaconda Company by the Peter Antonioli estate, but the lease was dropped late in 1961.

Iron Ore.—Compared with that of 1961, production dropped by 25,067 long tons to the lowest output since 1955. The entire State output was shipped by Ralls & Harris Bros. from the Iron Cross (2,930 tons) and Iron Magnet (6,271 tons) open-pit mines near Radersburg, Broadwater County, for use by the cement industry.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals[1]

Year	Mines producing		Material sold or treated[2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1953–57 (average)	126	10	7,758	29,488	$1,032	6.178	$5,592
1958	125	11	10,861	26,003	910	3,631	3,286
1959	96	14	8,779	28,551	999	3,420	3,096
1960	129	13	12,317	45,922	1,607	3,607	3,265
1961	135	17	12,792	35,377	1,238	3,490	3,227
1962	107	5	11,835	24,387	854	4,561	4,948
1862–1962	----------	----------	(3)	17,682,000	403,329	837,457	627,887

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	81,289	$55,490	16,748	$4,804	66,170	$15,909	$82,827
1958	90,683	47,699	8,434	1,974	33,238	6,781	60,649
1959	65,911	40,469	7,672	1,765	27,848	6,405	52,734
1960	91,972	59,046	4,879	1,142	12,551	3,238	68,298
1961	104,000	62,400	2,643	544	10,262	2,360	69,770
1962	94,021	57,917	6,121	1,126	37,678	8,666	73,511
1862–1962	7,778,000	2,599,117	923,000	144,270	2,709,000	514,277	4,288,880

[1] Includes recoverable metal content of gravel washed (placer mines), ore milled, old tailings retreated, and ore, old slag, and copper precipitates shipped to smelters during the calendar year indicated. Owing to rounding, individual items may not add to totals shown.
[2] Does not include gravel washed.
[3] Data not available.

TABLE 8.—Gold production at placer mines

Year	Mechanical and hydraulic methods [1]			Small-scale hand methods			Total		
	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)
1953–57 (average)	6	229	1,638	[2] 4	1	42	10	230	1,680
1958	7	209	1,069	4	1	19	11	210	1,088
1959	9	157	973	5	4	29	14	161	1,002
1960	2	2	41	11	8	94	13	10	135
1961	5	30	82	12	4	50	17	34	132
1962	[3] 3	7	64	2	4	46	5	11	110

[1] Combined to avoid disclosing individual company confidential data.
[2] Includes surface and underground (drift) placers.
[3] Includes 1 dragline dredge, 1 nonfloating washing plant, and 1 electric shovel.

Beneficiation and smelting of ore from the Carter Creek deposit in Beaverhead and Madison Counties were described.[7]

Lead.—Output of lead was 3,478 tons above the 2,643 tons produced in 1961. Approximately 70 percent was produced by The Anaconda Company from the Badger State mine and shipments were from the purchased Government low-grade manganese stockpile and the Emma mine stockpile. Production from the Badger State was the first lead-bearing ore mined by the company since 1960. Other major production came from the Anaconda slag-fuming operation at East Helena, Lewis and Clark County; the Trout Mining Co. Algonquin mine, Granite County; and the Maulden mine of Ida B. Hand, Beaverhead County.

Two operators of lead-zinc mines received subsidy payments totaling $43,097 for the production of 277 tons of lead ($20,410) and 750 tons of zinc ($22,687) under the Government program to stabilize the mining of lead and zinc by small producers. Six operators were certified as eligible to receive payments on 1,528 tons of lead and 2,128 tons of zinc, but production by these operators was far below the eligible amounts.

A comprehensive study of lead-zinc marketing by small producers was published.[8]

Manganese.—Shipments of manganese ore and concentrate (35 percent or more manganese) totaled 24,758 short tons—a 41-percent increase over that of 1961. Manganiferous ore and concentrate (5 to 35 percent manganese) shipments increased 1 percent to 2,264 short tons.

The Anaconda Company did not mine manganese ore during 1962 but shipped metallurgical-grade nodules from stocks, mostly for use at the company ferromanganese plant at Anaconda. Nodules were produced at the sintering plant at Anaconda in October and November from manganese raw material obtained from the Emma mine stockpile at Butte and from low-grade manganese ore from a Government

[7] Holmes, Wesley T., II, W. Floyd Holbrook, and Lloyd H. Banning. Beneficiating and Smelting Carter Creek, Mont., Iron Ore. BuMines Rept. of Inv. 5922, 1962, 21 pp.
[8] Young, Francis M., Frank A. Crowley, and Uuno M. Sahinen. Marketing Problems of Small Business Enterprises Engaged in Lead and Zinc Mining. Montana Bureau of Mines and Geol. Bull. 30, 1962, 58 pp.

stockpile. Anaconda purchased the Government stockpile in August for $8 per ton. It contained 136,143 long dry tons of low-grade manganese carbonate ore (rhodochrosite) averaging approximately 19 percent manganese. The ore, stockpiled at Butte (123,345 tons) and Philipsburg (12,798 tons), was purchased by the Government from 1951 to 1958. In addition to manganese, values of gold, silver, lead, and zinc recovered from the ore were included in the State totals.

Taylor-Knapp Co. mined 11,054 long tons of ore from the Moorlight group near Philipsburg, Granite County. Twenty tons of chemical-grade concentrate was sold, and battery-grade material was shipped to battery manufacturers. Shipments averaged 40.1 percent manganese. Taylor-Knapp also shipped 2,021 long tons of manganif-

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1962, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
Beaverhead	13	----	1,826	$64	40,832	$44
Broadwater	7	----	82	3	1,515	2
Fergus	2	----	8	[1]	106	[1]
Flathead	3	----	10	[1]	6,728	7
Granite	15	----	1,847	65	357,753	383
Jefferson	16	----	962	34	54,046	59
Judith Basin	2	----	1	[1]	709	1
Lewis and Clark	8	1	183	6	12,661	14
Madison	11	1	1,503	53	41,223	45
Meagher	2	----	5	[1]	4,203	5
Mineral	1	----	----	----	10	[1]
Missoula	3	----	29	1	22	[1]
Powell	3	1	149	5	234	[1]
Sanders	4	----	20	1	940	1
Silver Bow	9	1	17,657	618	4,026,697	4,369
Unassigned	3	----	6	[1]	256	[1]
Undistributed [4]	5	1	99	3	12,779	14
Total [5]	107	5	24,387	854	4,560,714	4,943

County	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
Beaverhead	10	$6	155	$28	23	$5	$143
Broadwater	16	10	5	1	3	1	16
Fergus	----	----	[2]	[1]	[2]	[1]	[1]
Flathead	2	1	----	----	----	----	9
Granite	97	59	292	54	1,855	427	996
Jefferson	33	20	109	20	92	21	154
Judith Basin	[2]	[1]	13	2	2	1	4
Lewis and Clark	[3]	[3]	[3]	[3]	7,052	1,622	1,837
Madison	4	3	1	[1]	1	[1]	101
Meagher	1	[1]	133	25	8	2	32
Mineral	1	[1]	----	----	----	----	[1]
Missoula	----	----	----	----	----	----	1
Powell	[2]	[1]	3	1	[2]	[1]	6
Sanders	8	5	40	7	6	1	15
Silver Bow	93,845	57,808	4,319	795	28,636	6,586	70,176
Unassigned	[2]	[1]	[2]	[1]	[2]	[1]	1
Undistributed [4]	4	3	1,051	193	[2]	[1]	19
Total [5]	94,021	57,917	6,121	1,126	37,678	8,666	73,511

[1] Less than $500.
[2] Less than 0.5 ton.
[3] Included with "Undistributed" to avoid disclosing individual company confidential data.
[4] Includes values and quantities that cannot be shown separately for Deer Lodge, Lincoln, and Ravalli Counties.
[5] Data may not add to totals shown because of rounding.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	30	3,051	2,896	2,786	7,500	4,200	7,000
Dry gold-silver	18	7,754	1,752	62,855	71,100	7,300	52,300
Dry silver	27	23,800	430	127,908	88,100	205,000	132,500
Total	75	34,605	5,078	193,549	166,700	216,500	191,800
Copper	9	10,742,516	15,034	2,506,824	181,139,400	600	100
Lead	11	2,233	236	14,442	4,700	710,600	65,400
Lead-zinc	5	147	3	1,204	500	104,300	17,600
Zinc	3	[2] 940,000	2,956	1,797,431	1,859,900	9,215,600	60,973,700
Total	28	11,684,896	18,229	4,319,901	183,004,500	10,031,100	61,056,800
Other lode material:							
Dry gold-silver old tailings, gold-silver assay rejects and gold-silver mill cleanings [3]	5	23,629	724	19,226	29,800	1,700	300
Dry silver old tailings	5	5,112	244	27,399	27,300	49,500	83,700
Copper precipitates					4,813,600		
Lead-zinc assay rejects	1	40	2	628	100	5,000	8,200
Zinc slag	1	86,584				1,938,200	14,015,200
Total lode material	107	11,834,866	24,277	4,560,703	188,042,000	12,242,000	75,356,000
Gravel (placer operations)	5	[4]	110	11			
Total	112	11,834,866	24,387	4,560,714	188,042,000	12,242,000	75,356,000

[1] Detail will not necessarily add to total, because some mines produce more than one class of material.
[2] Includes 177,666 tons of manganese ore containing gold, silver, copper, lead, and zinc.
[3] Combined to avoid disclosing individual company confidential data.
[4] 10,953 cubic yards.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1962 by types of material processed and methods of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation	207	40			
Concentration and smelting of concentrates	18,004	4,198,844	183,007,100	9,017,800	59,554,700
Total	18,211	4,198,884	183,007,100	9,017,800	59,554,700
Direct smelting:					
Ore	5,096	314,566	164,100	1,229,800	1,693,900
Old tailings, mill cleanings, and assay rejects [1]	970	47,253	57,200	56,200	92,200
Old slag				1,938,200	14,015,200
Copper precipitates			4,813,600		
Total	6,066	361,819	5,034,900	3,224,200	15,801,300
Placer	110	11			
Grand total	24,387	4,560,714	188,042,000	12,242,000	75,356,000

[1] Combined to avoid disclosing individual company confidential data.

erous material containing 23.3 percent manganese to metallurgical users. Taylor-Knapp purchased 22 long tons of oxide ore containing 19.3 percent manganese from Ross Hayworth (Little Emma mine) and 311 long tons of ore (25 percent manganese) from Trout Mining Co.

A preliminary study of the extraction of manganese from low-grade dolomitic materials from the Philipsburg district was published.[9]

Silver.—Output of silver was the highest since 1957. The increased market price caused the value of production to rise 53 percent ($1.72 million) compared to the quantity rise of 31 percent (1.07 million ounces) over corresponding figures for 1961. The increase in output was largely attributable to the beginning of production from the Badger State mine (Elm Orlu-Black Rock project) and shipments from the Emma stockpile and the purchased Government manganese stockpile. These three sources supplied 1,517,324 ounces. Production from the Butte Hill mines increased, whereas output from the Berkeley pit and Kelley mine declined.

Mines in Silver Bow County supplied 88 percent of the State total, Granite County contributed 8 percent, and the remaining 4 percent came from 16 other counties.

Steel.—The construction of a steel plant at Anaconda, Deer Lodge County, by Gulf State Lands and Industries, Inc., first proposed in 1959, was dependent upon securing adequate financing.

Thorium.—The Atomic Energy Commission announced in its annual report to the Congress that thorium reserves in the Lemhi Pass area of Idaho and Montana contained 100,000 tons of thorium oxide (ThO_2) and that the eventual development of much larger reserves was a possibility.

Tungsten.—Output declined sharply because of the February shut down of the Minerals Engineering Co. mill near Glen, Beaverhead County. Production from the company Calvert pit near Wise River was stopped in December 1961.

Uranium.—Production of uranium was the lowest since before 1956 and far below the 1961 output of 729 tons. All of the output came from the Swamp Frog property, Carbon County, operated by John Kummerfeld.

Zinc.—Output was 37,678 tons, an increase of 27,416 tons from the 1961 total. The increase was attributable to the start of production from the Badger State mine (Elm Orlu-Black Rock block-caving project) by The Anaconda Company. Company production from the Badger State mine and shipments from the Emma mine stockpile and the purchased Government manganese stockpile accounted for 76 percent of the State total. Nineteen percent of the State output came from old slag processed at the Anaconda slag-fuming plant adjacent to the American Smelting and Refining Company lead smelter at East Helena. Trout Mining Co. (Algonquin mine) and Taylor-Knapp Co. (True Fissure mine) produced 1,141 tons and 710 tons, respectively, from mines in the Flint Creek district, Granite County. Both silver-zinc mining operations were closed in September.

Production from the Badger State mine, which supplied the first zinc ore mined by Anaconda since 1960, began in February. The ore was milled and the concentrate roasted at the Anaconda Reduction Works, Anaconda, and shipped to the company electrolytic zinc

[9] Sullivan, G. V., L. L. Brown, and R. G .Peterson. Extraction of Manganese From Low-Grade Dolomitic Materials by a Roast-Leach Process. BuMines Rept of Inv. 6121, 1962, 24 pp.

plant at Great Falls. Resumption of zinc mining and concentrating provided 175 jobs at Butte and 75 at Anaconda.

The electrolytic zinc plant at Great Falls produced 133,462 tons of High Grade and Special High Grade zinc from domestic and foreign concentrates.

NONMETALS

Asbestos.—Zonolite Co. announced plans to build a pilot plant to recover short-fiber tremolite asbestos as a coproduct with vermiculite from the company operation at Libby, Lincoln County. The asbestos, to be separated from the vermiculite by a wet-milling process, was to be utilized by the company. Considerable quantities of short-fiber asbestos had been purchased for use by the company in past years.

Barite.—The quantity and value of barite sold or used by producers almost tripled compared with 1961 totals. The mineral was mined and ground near Greenough, Missoula County, by Baroid Sales Division, National Lead Co. Output was used primarily as a weighting agent in oil-well-drilling mud.

Exploratory drilling at a barite prospect discovered in 1960 near Eureka, Lincoln County, was a joint venture of the Montana Bureau of Mines and Geology, Great Northern Railway Co., and Pacific Power & Light Co.

Cement.—The quantity and value of cement shipments were slightly higher than in 1961. Construction of auxiliary facilities by Ideal Cement Co., Montana Division, the only producer of cement in the State, was completed at the Trident, Gallatin County, plant. Destinations within the State accounted for 75 percent of the cement sold. Shipments also were made to Utah, Wyoming, North Dakota, and Idaho.

Work began in April on the Permanente Cement Co. plant near the old mining town of Montana City, 3 miles south of East Helena, Lewis and Clark County. Completion of the 1.4-million-barrel-capacity, $9.6 million facility was expected early in 1963. Thereafter, shipments of cement for the Yellowtail Dam on the Big Horn River were to begin. The company indicated that some of the plant output was to be marketed in Wyoming, Idaho, and North Dakota.

Clays.—There was a small increase in the output of miscellaneous clay, which contrasted with a decline of more than 50 percent in fire clay production compared with 1961 totals. No bentonite was mined.

Miscellaneous clay for making heavy clay products was mined in Fergus and Yellowstone Counties. Two companies in Cascade and Yellowstone Counties produced shale and expanded it for lightweight aggregate. The small output of fire clay came from Cascade and Deer Lodge Counties.

Fluorspar.—Roberts Mining Co., the only producer in the State, mined fluorspar at its Crystal Mountain open pit in Ravalli County and shipped it to the company-owned plant at Darby. The steel industry continued to be the major consumer. Fluorspar deposits in Montana were described.[10]

[10] Sahinen, U. M. Fluorspar Deposits in Montana. Montana Bureau of Mines and Geol. Bull. 29, April 1962, 38 pp.

Gypsum.—The quantity and value of crude gypsum mined decreased 6 percent compared with the 1961 totals. Two mines in Fergus County furnished the output, most of which was calcined and sold as ground gypsum, and some of which was used to make wallboard and lath. Uncalcined gypsum was used as a retarder in portland cement.

On June 19, employees at the Hanover mine of Ideal Cement Co. completed 4,000 consecutive days without a lost-time accident. The last lost-time accident occurred in 1951.

Lime.—Output of lime dropped 12 percent and value increased 6 percent in comparison with 1961 totals. In Deer Lodge County, The Anaconda Company made quicklime for metallurgical use, and Ellis-ton Lime Co. (Powell County) produced and marketed quicklime and hydrated lime. Three sugar-refining companies calcined limestone for use at four plants in Big Horn, Missoula, Richland, and Yellowstone Counties.

Phosphate Rock.—A decrease of 11 percent in the quantity of marketable phosphate rock produced was accompanied by a 4-percent increase in value. Mines in Beaverhead, Powell, and Silver Bow Counties contributed to the output, part of which was exported to British Columbia. Elemental phosphorus, phosphoric acid, and phosphate fertilizers were produced by processing the rock.

Rocky Mountain Phosphate Co., Butte, the only producer of defluorinated phosphate rock for use as animal feed supplement in the West, announced plans to construct a facility at Garrison. The main purpose for moving from Butte was to be closer to the source of raw material.

Sand and Gravel.—There was an increase of 3.8 million tons and $4.1 million in the quantity and value of sand and gravel output. Totals were 18.5 million tons and $17.6 million, compared with 14.7 million tons and $13.5 million in 1961. Most of the advance was attributed to increased road construction and maintenance by the Bureau of Public Roads and the State highway department. Larger quantities of sand and gravel used at the Yellowtail Dam project of the Bureau of Reclamation also contributed to the increase.

Thirty-seven of the 56 counties in the State had sand and gravel production. Cascade County, with output in excess of 1 million tons, was the leading source of sand and gravel. Use distribution was road material, 91 percent; building, 5 percent; and miscellaneous uses including railroad ballast, 4 percent. Corresponding figures in 1961 were 92, 6, and 2 percent.

Stone.—Quantity and value of stone output dropped 34 and 8 percent, respectively, compared with the 1961 totals. Curtailed use of stone at projects of the Bureau of Public Roads, U.S. Forest Service, and U.S. Army Corps of Engineers accounted for the reduced production. Output of limestone, the principal stone quarried, was slightly lower than in 1961. Limestone was used mainly for making cement and lime. More sandstone and less basalt and granite were quarried than in 1961. Travertine for building and decorative purposes was produced and marketed by two companies in Park County.

Most of the limestone was quarried in Gallatin and Deer Lodge Counties; sandstone came from Missoula, Gallatin, and Beaverhead Counties; and Flathead County was the major source of basalt.

TABLE 12.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Building	863	$1,116	949	$1,373
Road material	1,029	964	599	538
Fill	97	90	233	264
Railroad ballast	114	85	(1)	(1)
Other [2]	19	14	343	231
Total	2,122	2,269	2,124	2,407
Government-and-contractor operations:				
Building	73	145	57	147
Road material	12,482	11,068	16,157	14,978
Fill	9	10	118	93
Other [2]	15	15	17	17
Total	12,580	11,237	16,349	15,235
All operations:				
Building	936	1,261	1,006	1,520
Road material	13,511	12,031	16,756	15,516
Fill	107	100	350	357
Railroad ballast	114	85	(1)	(1)
Other [2]	34	29	361	248
Grand total [3]	14,702	13,506	18,473	17,642

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Sand and gravel used for miscellaneous and unspecified purposes, including items indicated by footnote 1.
[3] Data may not add to totals shown because of rounding.

Sulfur.—Production and shipments of high-purity elemental sulfur by Montana Sulphur & Chemical Co. were higher than in 1961. Hydrogen sulfide, the raw material used in recovery process, was furnished from two oil refineries in the Billings area, Yellowstone County.

Talc.—Output and value of talc were 17 percent higher and 4 percent lower, respectively. Four companies produced from eight mines—one in Beaverhead County and seven in Madison County. Most of the talc was processed at grinding plants at Barratts, Beaverhead County; Three Forks, Gallatin County; and East Helena, Lewis and Clark County. Out-of-State shipments for grinding were made to plants at Grand Island, Nebr.; Ogden, Utah, and Pomona and Los Angeles, Calif.

There was a significant change in the quantity of talc consumed in the paper and ceramics industries. Uses were as follows (1961 percentages are in parentheses): Paint, 47 percent (52 percent); paper, 34 percent (15 percent); ceramics, 14 percent (24 percent); and miscellaneous, including cosmetics, insecticides, rice polishing, textiles, and rubber, 5 percent (9 percent).

Vermiculite.—Output of crude vermiculite was 8 percent higher than in 1961. The Libby, Lincoln County, open-pit mine of Zonolite Co. continued to be the principal source of vermiculite in the United States. Most of the production was shipped out of the State to exfoliating plants, but some was expanded by a company at Great Falls, Cascade County. A proposed merger of Zonolite Co. with W. R. Grace & Co., a leading producer of chemicals with other inter-

ests, was announced late in the year. Vermiculite found use mainly for insulation purposes, lightweight aggregate, and soil conditioning.

MINERAL FUELS

Coal.—Output of bituminous coal and lignite was 382,000 tons, compared with 371,000 tons in 1961. Among the 19 active mines (16 underground and 3 open pit) in 8 counties, 14 produced bituminous coal and 5 yielded lignite. Nine mines in Musselshell County furnished most of the bituminous coal. Production also came from Carbon, Blaine, Rosebud, and Cascade Counties. Richland was the principal lignite-producing county followed by Sheridan and Custer Counties.

Peat.—Production of peat from deposits in Ravalli and Lake Counties increased substantially over the 1961 total.

Petroleum and Natural Gas.[11]—Recovery of crude oil continued to increase. A record 31.6 million barrels ($76.7 million) was produced; 1961 output was 30.9 million barrels ($74.8 million). Petroleum represented 40 percent of the total value of mineral output in Montana. Thirty-nine percent of the crude oil was recovered from the Pine, Cabin Creek, and Elk Basin fields, each field exceeding 3 million barrels. Other fields yielding more than 1 million barrels were Sumatra, Cut Bank, Poplar-East, and Pennel. Six oilfields—Lookout Butte, Benrud-East, Wildcat, Musselshell, Whitlash-West, and Bascom—began producing.

Nine refineries processed 28.1 million barrels of crude oil, 4.2 million barrels more than in 1961. Montana wells furnished 40 percent of the total and Wyoming wells supplied most of the remainder. During 1962, 419 wells were drilled (417 in 1961); of these 190 yielded oil, 18 produced gas, and 211 were dry.

Marketed production of natural gas reached 30.0 billion cubic feet, compared with 33.9 billion cubic feet in 1961. The Cut Bank-Reagan field continued to be the major source of natural gas (8.6 billion cubic feet). Seven other fields that produced over 1 billion cubic feet were Cedar Creek, Bowdoin, Keith Block, Dry Creek, Whitlash, Bowes, and Cabin Creek.

Fifty years after the discovery of natural gas on the Cedar Creek anticline (Williston Basin), attention was again focused on the area. Major oil companies drilled in the Pennel and Lookout Butte fields, Fallon County; development took place in the Coral Creek unit at the southern end of the Lookout Butte field; and there was activity at the northwestern end of the anticline near Glendive, Dawson County, in the Seven Mile field. New production along the anticline came from depths of 6,500 to 10,000 feet.

A well drilled by McAllister Fuel Oil Corp., 17 miles northwest of the Brorson field, may be the most important wildcat in the Montana portion of the Williston Basin. Oil was recovered on a drillstem test in the Devonian at about 10,000 feet; production from this horizon has been rare in this area.

[11] Montana Oil and Gas Conservation Commission. Montana Oil and Gas Statistical Bulletin and Annual Review, 1962.

A wildcat, near the Canadian border in Sheridan County and about 26 miles from the nearest production in the Outlook field, apparently struck oil in the Madison formation.

Humble Oil & Refining Co.; Texaco, Inc.; Phillips Petroleum Co.; and Union Oil Co. began large-scale water-flooding in the Cut Bank field, Glacier County. Humble's northwest unit of about 2,700 acres was formed as one of several proposed units for flooding Cut Bank sand. Seven producing wells were converted to injection wells. It was predicted that ultimately production could be doubled from the formation in the area to be flooded.

Montana Power Co. announced plans to drill a 2,000-foot well near Deer Lodge, Powell County, in an attempt to find a formation suitable for the storage of natural gas.

Oil and gas leases on the Northern Cheyenne Indian Reservation were open for bidding for the first time since 1956.

Effective July 1, the Montana Oil & Gas Conservation Commission reduced its tax on production of oil and natural gas by 50 percent. Early in 1962, the Commission also established 320-acre well spacings in the Brorson field area of Richland County. Split spacings—80 acres on the western edge and 160 acres on the eastern edge—were approved for the Pennel field, Fallon County, because of variations in the pay thickness of the producing horizons. For the Benrud field northwest of Tule Creek, Roosevelt County, spacings of 160 acres were approved.

REVIEW BY COUNTIES

Mineral production for 1962 was reported from 48 of the 56 counties. Silver Bow County accounted for 38 percent of the total mineral-output value. Only counties with significant metal, nonmetal, or fuels developments are discussed in the following review.

Beaverhead.—Mines in the county supplied 1,826 ounces of gold, 40,832 ounces of silver, 10 tons of copper, 154 tons of lead, and 23 tons of zinc. The five mines in the Argenta district yielded 73 percent of the value of production. Lead ore (1,269 tons) from the Maulden mine yielded 145 ounces of gold, 4,050 ounces of silver, 2 tons of copper, 153 tons of lead, and 22 tons of zinc. High-grade gold ore was mined at the Yellow Band property, which was the leading gold-producing mine outside of Silver Bow County, and 154 ounces of gold and 3,236 ounces of silver were produced from the Henry mine operated by Alumont, Inc. Gold ore was taken from the Cross mine, and part of the Midnight mine dump was shipped.

Spokane National Mines, Inc., continued exploration and development of the New Departure mine, Blue Wing district, and produced 4 ounces of gold, 4,446 ounces of silver, 1 ton of lead, and 2 tons of zinc. The company completed electrification of its mining and milling operations.

The largest silver output was from the Comet mine (Dick Tunstill), Elkhorn district, and the Hecla mine (Lively Mining Co.), Bryant district, yielding 9,262 ounces (30 ounces per ton) and 8,633 ounces (12 ounces per ton), respectively. A total of 481 tons of ore from the Polaris mine, operated by Ida B. Hand in the Polaris district, yielded 9 ounces of gold, 4,673 ounces of silver, and 1 ton of copper. Other

TABLE 13.—Value of mineral production in Montana, by counties[1]

(Thousand dollars)

County	1961	1962	Minerals produced in 1962, in order of value
Beaverhead	(2)	(2)	Phosphate rock, tungsten, gold, silver, lead, talc, stone, thorite concentrate, copper, zinc, sand and gravel.
Big Horn	$373	$460	Sand and gravel, petroleum, lime, natural gas.
Blaine	611	429	Petroleum, natural gas, coal, sand and gravel.
Broadwater	157	175	Sand and gravel, iron ore, copper, gold, silver, lead, zinc.
Carbon	7,409	9,845	Petroleum, natural gas, stone, coal, uranium.
Carter	52	37	Petroleum.
Cascade	1,017	1,224	Sand and gravel, clays, coal, stone.
Custer	128	144	Sand and gravel, coal.
Dawson	3,462	4,597	Petroleum, sand and gravel, coal.
Deer Lodge	836	783	Lime, stone, sand and gravel, silver, copper, gold, clays.
Fallon	16,343	17,462	Petroleum, natural gas.
Fergus	391	728	Sand and gravel, gypsum, clays, gold, silver, zinc, lead.
Flathead	296	370	Sand and gravel, stone, silver, copper, gold.
Gallatin	(2)	(2)	Cement, stone, sand and gravel, mica.
Glacier	1,179	2,050	Petroleum, sand and gravel.
Granite	[3] 1,683	1,505	Manganese, zinc, silver, gold, copper, lead, manganiferous ore, sand and gravel, stone.
Hill	64	50	Sand and gravel.
Jefferson	194	229	Stone, silver, gold, zinc, copper, lead, sand and gravel.
Judith Basin	124	44	Sand and gravel, lead, silver, zinc, gold, copper.
Lake	(2)	(2)	Sand and gravel, peat.
Lewis and Clark	1,651	2,128	Zinc, sand and gravel, lead, silver, gold, stone, copper.
Liberty	602	776	Petroleum, natural gas.
Lincoln	(2)	(2)	Vermiculite, sand and gravel, gold, lead, zinc, silver.
McCone	136	409	Petroleum.
Madison	[3] 1,056	903	Talc, sand and gravel, gold, silver, stone, copper, zinc, lead.
Meagher	53	32	Lead, silver, zinc, copper, gold.
Mineral	(2)	65	Sand and gravel, copper, silver.
Missoula	193	465	Sand and gravel, stone, barite, lime, gold, silver.
Musselshell	4,557	4,110	Petroleum, coal.
Park	54	138	Stone, sand and gravel.
Phillips	340	249	Natural gas, sand and gravel.
Pondera	27	69	Petroleum, sand and gravel.
Power River	(2)	(2)	Coal.
Powell	(2)	(2)	Phosphate rock, lime, sand and gravel, stone, gold, lead, silver, copper, zinc.
Prairie	(2)	(2)	Sand and gravel.
Ravalli	(2)	597	Fluorspar, peat, sand and gravel, gold, silver.
Richland	715	920	Coal, lime, petroleum.
Roosevelt	7,675	7,254	Petroleum, sand and gravel.
Rosebud	6,142	5,866	Petroleum, coal.
Sanders	(2)	15	Lead, copper, zinc, silver, gold.
Sheridan	2,380	3,248	Petroleum, coal, sand and gravel.
Silver Bow	67,303	72,342	Copper, zinc, silver, manganese, lead, gold, phosphate rock, sand and gravel.
Stillwater	(2)	(2)	Sand and gravel.
Teton	34	35	Petroleum, sand and gravel.
Toole	1,638	1,422	Petroleum, sand and gravel, natural gas.
Treasure	32	53	Sand and gravel.
Valley	180	55	Do.
Yellowstone	1,474	1,519	Petroleum, sand and gravel, lime, clays.
Combined counties [4]	[3] 24,930	21,211	
Undistributed [5]	[3] 28,742	26,643	
Total	[3] 184,233	190,656	

[1] No production reported in Chouteau, Sweet Grass, and Wheatland Counties.
[2] Figure withheld to avoid disclosing individual company company confidential data; included with "Undistributed."
[3] Revised figure.
[4] Petroleum and natural gas production from fields underlying two or more counties. See Combined Counties section.
[5] Includes value of mineral production that cannot be assigned to specific counties and values indicated by footnote 2.

gold, silver, and copper production came from the Three Aces mine, Dillon district; Quartz Hill mine, Quartz Hill district; and the Gray Jockey and Harrison mines, Vipond district.

Phosphate rock produced at the Canyon Creek and East La Marche mines of Victor Chemical Works was shipped to the company elemental phosphorus plant at Silver Bow. Talc was mined at the

Smith-Dillon property by Tri-State Minerals Co. Some of the output was ground at the company Barratts mill.

Big Horn.—Recovery of crude oil from the three fields in the county was 16,000 barrels less than in 1961. Natural gas withdrawals from the Hardin field remained at about 54 million cubic feet. Limestone was calcined for use at the Holly Sugar Corp. Hardin plant. Output of sand and gravel more than doubled compared with that of 1961. Work at the Bureau of Reclamation Yellowtail Dam project accounted for the increase.

Broadwater.—Ralls & Harris Bros. mined magnetite containing 45 percent iron from two mines in the Cedar Plains district near Radersburg.

The Hard Cash (Copper Queen) mine in the Cedar Plains district, operated by Wayne Miller, was the leading gold (31 ounces), silver (903 ounces), and copper (16 tons) mine. In the Park (Indian Creek) mining district, 33 tons of ore from the Alpha claim yielded 2 ounces of gold, 259 ounces of silver, 4 tons of lead, and less than 1 ton of zinc; a minor quantity of lead ore came from the Pioneer mine.

Gold ore was shipped from the Miller Slim Jim mine, Backer district, and the January and Stabler properties in the Beaver district. A small quantity of lead-zinc ore was extracted from the Silver Saddle mine.

Carbon.—The county ranked second in value of nonmetals and fuels output ($9.9 million). Production increases were reported for petroleum, natural gas, stone, and coal. Recovery of crude oil from the Elk Basin field, the third ranking oilfield in the State, was 3.7 million barrels, about 1 million barrels more than in 1961. The Dry Creek field yielded 2 billion cubic feet of natural gas. Two bituminous coal mines were active.

Carter.—Production of crude oil from the Repeat field dropped to 18,000 barrels, 8,000 barrels less than in 1961.

Cascade.—According to The Anaconda Company annual report to shareholders, production of electrolytic copper at the Great Falls copper refinery was at the rate of 22.5 million pounds monthly, except during September and October when monthly production was reduced to less than 17 million pounds because of a labor strike at Butte. The electrolytic zinc plant was operated at 88 percent of capacity during the first half of 1962 and at 75 percent of capacity during the second half. Cadmium recovered as a byproduct of processing foreign and domestic zinc concentrates totaled 596 tons.

The county was the leading source of sand and gravel and clay in the State. A large increase in output of sand and gravel resulted from increased municipal and county work. There was a sharp decrease in the tonnage of fire clay mined at the Armington pit for refractory use at the Anaconda Reduction Works in Deer Lodge County.

Dawson.—Recovery of crude oil from five fields was 1.8 million barrels, an increase of 400,000 barrels over that of 1961. The Gas City field was the principal source. No output was reported from the Seven Mile field which began producing in 1961.

Deer Lodge.—Improvements in the copper smelting division of the Anaconda Reduction Works at Anaconda included the installation of a belt conveyor to carry a mixture of hot calcine and wet concentrate to

the reverberatory furnaces. Formerly the reverberatory feed was tiammed in rail cars from the roasters to the furnaces. The No. 4 reverberatory furnace was rebuilt according to an improved design that included a tunnel to facilitate tapping the matte into kettles for conveying to the converters.

Dismantlement and rehabilitation of equipment to be transferred to the new Butte concentrator was begun in May. Milling of copper ore was to be continued at Anaconda until 1964. Zinc concentrate was roasted, and byproduct sulfur dioxide was used to produce sulfuric acid. As in 1960–61, the electrolytic zinc plant was not operated.

The Extractive Metallurgical Research Department of The Anaconda Company was recognized as a division of the company. Plans were announced for a new research laboratory to be constructed at Anaconda to facilitate metallurgical research and development for all company operations.

The Anaconda annual report to shareholders reported manganese nodule production of 32,247 short tons, the highest since 1958, and ferromanganese output of 10,758 short tons. Arsenic trioxide (white arsenic) was produced as a byproduct of smelting arsenic-containing copper ore.

Silver ore (1,207 tons) from the Cameron mine (T.M. Moe), Blue-eyed Nellie district, yielded 17 ounces of gold, 8,811 ounces of silver, and 2 tons of copper. Silver ore also was produced at the Champion mine, Orofino district, and a small quantity of gold ore was mined at the Gold Coin property, Georgetown district.

The United Steelworkers of America became the representative of approximately 1,700 employees of the Anaconda Reduction Works by defeating the International Union of Mine, Mill, and Smelter Workers in an election supervised by the National Labor Relations Board. Mine-Mill had represented employees at Anaconda for 61 years.

There was a slight decrease in the tonnage of limestone mined at Brown's quarry. Most of the output was calcined to quicklime for use at The Anaconda Company ore-processing and metallurgical operations.

Fallon.—Crude oil production increased from 6.6 million barrels in 1961 to 7.1 million barrels. The Cabin Creek field contributed 3.9 million barrels and the Pennel field 1.4 million barrels to the total. Lookout Butte, a new field, yielded 888,000 barrels.

Natural gas withdrawals, from three fields, were 7 billion cubic feet. Cedar Creek field, the second most productive source of natural gas, yielded 5.8 billion cubic feet, and Cabin Creek field produced over 1 billion cubic feet.

Fergus.—Two Warm Springs district mines—Black Bull (G.S. Abott) and Silver Dyke (Tom Dowen)—supplied 8 ounces of gold and 106 ounces of silver.

Gypsum was mined near Heath by United States Gypsum Co. and near Hanover by Ideal Cement Co. Clay mined at pits near Lewistown was used by Lewistown Brick & Tile Co. to make heavy clay products. A sharp increase in production of sand and gravel resulted from an accelerated program of the Bureau of Public Roads.

Flathead.—The Anaconda Aluminum Co. Columbia Falls reduction plant was operated at capacity to meet the demand for aluminum from

other company plants and customers. Natural gas replaced electricity to heat boilers and casting furnaces at the plant.

Silver ore was mined at the West Flathead and Ole properties in the Hog Heaven mining district. A Star Meadow district mine—Sanko Creek—supplied a small quantity of copper ore.

A geologic study of the Kootenai-Flathead area was published.[12]

Gallatin.—Nonmetallic commodity production increased slightly compared with that of 1961. The Ideal Cement Co. plant at Trident continued to be the leading mineral industry operation in the county. The Trident quarry, the source of limestone used at the cement plant, led the State in stone production. Talc mined in Madison County was ground at the Three Forks plant of Sierra Talc Co. The only mica production in the State came from the vicinity of Gallatin Gateway.

Glacier.—Four oilfields yielded 794,000 barrels of crude oil, compared with 589,000 in 1961.

Granite.—Value of precious- and base-metal output was 18 percent below that of 1961, largely as a result of the shut down in September of the Flint Creek district Algonquin (Trout Mining Co.) and True Fissure (Taylor-Knapp Co.) properties. Trout produced 340 ounces of gold, 174,533 ounces of silver, 52 tons of copper, 190 tons of lead, and 1,141 tons of zinc. Taylor-Knapp Co., whose zinc ore was concentrated at the Trout company mill, mined 105,574 ounces of silver, 99 tons of lead, and 710 tons of zinc. Flint Creek district production also came from dump material shipped from the Bi-Metallic, Climax, Granite, and Potosi properties. Ross Hayworth produced 1,234 ounces of silver from the Little Emma mine and silver ore was mined from the New Seattle mine. Forty tons of lead-zinc rejects was shipped by the Montana Laboratory Co., Philipsburg.

In the Henderson district, John C. Bork & Sons produced 175 ounces of gold, 39,801 ounces of silver, and 23 tons of copper from the Black Pine mine. Gold-silver tailings were shipped from the Rumsey mine. Gold ore came from the Mickey and Gold Reef mines, and old tailings were shipped from the Jefferson property.

Production of manganese ore by Taylor-Knapp was reduced compared with the 1961 output. The halting of company zinc ore production was not accompanied by a cessation of manganese ore output.

In February, Trout Mining Co. was granted a $77,610 OME contract to explore for silver, lead, and zinc in the county.

Jefferson.—The value of metal output increased 22 percent over that of 1961; production was from operations at 18 properties. The leading silver, lead, and zinc producer was the Lahey Leasing Co. (Alta-Custer mine) in the Colorado district. The leading gold output was from ore and old tailings from the Basin Jib property, Cataract (Basin) district. Gold-silver ore (335 tons) from the Mount Thompson mine, operated by Curtiss and W. Olson in the Cataract district, yielded 104 ounces of gold and 5,337 ounces of silver. Other production from the Cataract district came from the Boulder (lead), Comet (gold-silver), Crystal (gold-silver), Hope & Bullion (lead-zinc), Lincoln (copper), Silver Hill (gold-silver), Eidelweiss (lead), Uranium (silver), and

[12] Johns, W. M. Geologic Investigations in the Kootenai-Flathead Area, Northwest Montana. No. 4, Western Flathead County, Montana Bureau of Mines and Geol. Bull. 29. 1962, 38 pp.

Mineral Deposit properties (lead-zinc). Production also was from the Big Jim mine (lead), Amazon district; Nancy mine (gold), Elkhorn district; and Humboldt and Poor Boy mines (silver), Homestake district.

The effects of a Pleistocene ice sheet in the northern Boulder Mountains were reported.[13]

Judith Basin.—Two metal mines were active; 30 tons of lead-zinc ore was mined at the Block property and 49 ounces of silver and 3 tons of lead were produced from the Tiger mine.

Lewis and Clark.—Increased production of lead and zinc by The Anaconda Company at the slag-fuming plant, East Helena, was responsible for a 20 percent increase in the value of metal output. Production from old lead-smelter slag at the fuming operation was 969 tons of lead and 7,008 tons of zinc. Most of the fume was shipped to the company's electrolytic zinc plant at Great Falls for processing. Operations were not curtailed by the labor strike of company employees at Butte.

Production by Helena Minerals Co. from the Sam Gaty mine, Ten Mile district, declined to 66 ounces of gold, 5,528 ounces of silver, 56 tons of lead, and 2 tons of zinc. Old silver-bearing tailings were shipped from the Peck mill, Helena district, and 2 tons of gold-silver assay rejects came from the Goodall Bros. assay office in Helena. Gold ore was mined at the Humdinger, Madison Gulch district; Black Watch, Poorman district; Monte Christo and Woodrow Wilson, Rimini (Vaughn) district; and Jay Gould mines, Stemple-Gould district.

A small quantity of gold and sliver was recovered from the Gruell Bar placer deposit, Helena district.

Liberty.—Recovery of crude oil from three fields in the county continued to increase. Output totaled 231,000 barrels, compared with 143,000 in 1961. Natural gas withdrawals declined to 3.8 billion cubic feet from 4.1 billion in 1961. Principal fields were Keith Block (2 billion cubic feet) and Whitlash (1 billion cubic feet).

Lincoln.—A small quantity of gold and silver was produced at the Gloria mine in the Libby district.

Madison.—Value of metal production declined 80 percent below that of 1961, largely as a result of the closing of the Mayflower gold property in the Renova district in 1961. Easton Pacific Mines produced 559 ounces of gold, 21,781 ounces of silver, and 2 tons of copper from the Easton Pacific mine, Virginia City district, before operations stopped in April. Exploration, development, and construction of new surface facilities were completed at the Virginia City district Pacific mine (Pacific Mines, Inc.); and 562 ounces of gold, 18,304 ounces of silver, and 1 ton of copper were produced. Output also was from the St. Lawrence (gold-silver), Brown's Gulch district; Cabin Lode (gold), Fairweather district; Strawberry (gold), Mineral Hill district; Leadora (lead), Rochester district; Red Pine (gold), Sheridan district; Amazon (silver), Stone Creek district; Black Ace (gold), Tidal Wave district; and El Fleeda (gold-silver ore and mill cleanings) and Kearsarge (gold) mines, Virginia City district.

[13] Ruppel, E. T. A Pleistocene Ice Sheet in the Northern Boulder Mountains, Jefferson, Powell, and Lewis and Clark Counties, Montana. U.S. Geol. Survey Bull. 1141–G, 1962, pp. G1–G22.

Talc mining continued to be the principal nonmetallic mineral industry in the county. Four companies operated seven mines—Tri-State Minerals Co. (Regal, Smith Dillon, and Treasure State), Sierra Talc Co. (Yellowstone), American Chemet Corp. (Madison and Rebish-Ike), and Al Kingery (Granite Creek).

McCone.—Crude oil recovery from the Richey-Southwest field increased to 166,000 barrels, 109,000 barrels more than in 1961.

Meagher.—The 653 tons of ore mined by Hoco, Inc., at the Cumberland mine, Castle Mountain district, yielded 4 ounces of gold, 4,182 ounces of silver, 133 tons of lead, and 8 tons of zinc. A small quantity of copper ore was extracted from the Copperopolis mine, Musselshell (Copperopolis) district.

Mineral.—Copper ore (32 tons) taken from the Dutchman mine, St. Regis district, by Oliver General Contracting Co. yielded 10 ounces of silver and 1 ton of copper.

The Bunker Hill Co. continued the exploration and development of the Nancy Lee mine in the Keystone district near Superior. Work consisted of deepening the main shaft 400 feet, cutting new shaft stations on the 940 and 1,090 levels, and extending the 640 adit level approximately 1,200 feet. No ore was processed at the Nancy Lee mill. Production was planned for the last half of 1963, providing sufficient ore was developed.

East Coeur d'Alene Mines, Inc., and The Bunker Hill Co. completed an agreement concerning 102 mining claims and mineral rights to 280 acres of homestead land controlled by East Coeur d'Alene near the Nancy Lee property. Under the agreement, Bunker Hill was to perform required assessment work on the claims and receive 70 percent of any production profits.

Missoula.—Thirteen ounces of gold was produced from the Nine Mile mine (L. Allen and W. Lamon), Nine Mile district. Gold and silver production was reported from two other mines—Dixie and Susan.

Barite mining by Baroid Sales Division, National Lead Co. continued near Greenough. Limestone was calcined to quicklime by American Crystal Sugar Co. for use at its refinery.

Musselshell.—Crude oil recovery dropped from 1.8 million barrels in 1961 to 1.5 million barrels. Bituminous coal output from nine mines was 58,000 tons, 20,000 tons less than in 1961. The Roundup No. 3 mine (Roundup Mining Co.) was the principal source of bituminous coal in Montana.

Phillips.—OME announced that Northern Continental, Inc., Grand Junction, Colo., had been granted a loan to explore for gold and silver in the county. OME was to provide half of the $76,300 contract.

Powell.—Metal output came from three mines—Hobby Horse (gold), Big Blackfoot district; Negros (lead), Nigger Hill district; and the Nancy Helen (gold), Ophir Gulch district. Placer gold was recovered by various producers in the Finn district.

Phosphate rock production was less than in 1961. Operations of Montana Phosphate Products Co. and George Relyea were active. Most of the output was exported to Trail, British Columbia, Canada, for manufacturing phosphate fertilizers by The Consolidated Mining & Smelting Company of Canada, Ltd. Limestone was calcined and marketed as quicklime and hydrated lime by Elliston Lime Co.

Ravalli.—A small quantity of gold ore came from the Larrigon mine. Hughes Creek Dredging Co., which operated a dragline dredge on Hughes Creek in the Overwich district, was the leading producer of placer gold in the State.

Richland.—Lignite production by Knife River Coal Mining Co. at Sidney increased moderately. Recovery of crude oil from the Sidney-Brorson field reached 75,000 barrels, compared with 48,000 barrels in 1961. Limestone was calcined to quicklime by Holly Sugar Corp. for its refinery.

Roosevelt.—Five oilfields yielded a total of 2.8 million barrels (2.9 million barrels in 1961) of crude petroleum. The county ranked third as a petroleum source. Initial production came from the Benrud-East field.

Rosebud.—Crude oil recovery was 2.4 million barrels, compared with 2.5 million in 1961. Sumatra was the leading field with an output of 2.3 million barrels. Initial production was reported from two new fields—Wildcat and Musselshell.

Sanders.—Lead-zinc ore was mined by lessees of the Jack Waite mine, Eagle district. Output was well below the quantity mined by American Smelting and Refining Company in 1961 before terminating its lease on the property. Six tons of copper, 97 ounces of silver, and 10 ounces of gold were produced from the Green Mountain mine in the Revais Creek (Dixon) district, and 10 ounces of gold and 20 ounces of silver came from the Montana Premier mine, Plains district. Raven Mines continued constructing a 50-ton-per-day flotation mill at the Raven mine property, and 31 tons of copper ore shipped to the Anaconda Reduction Works yielded 493 ounces of silver and 1 ton of copper.

Sheridan.—Oilfields in the county produced 1.4 million barrels of petroleum. This was 400,000 barrels more than in 1961. Output of 936,000 barrels from the Dwyer field, the leading producer in the county, was more than double the 1961 total of 444,000 barrels.

Silver Bow.—Output from The Anaconda Company mines continued to dominate metal-production statistics. Output of gold, silver, copper, lead, and zinc furnished 95.5 percent of the value of precious- and base-metal output in the State.

As in 1960–61, no manganese ore was mined in the county. However, ore from the Emma stockpile and the purchased Government low-grade stockpile was shipped to Anaconda, Deer Lodge County, for processing. Manganese carbonate (rhodochrosite) contained in the Badger State mine ore was not recovered.

Ore shipped from Butte to Anaconda by the Butte, Anaconda & Pacific Railway Co. was 12,164,484 tons, compared with 13,103,645 tons in 1961.

Highland Placers recovered a small quantity of gold at a washing plant in the Highland district.

Summit Valley (Butte) District.—Eight metal mines were operated. Copper ore from the Berkeley pit, Butte Hill mines (Mountain Con, Steward, and Leonard) and Kelley mine and zinc ore from the Badger State mine and two stockpiles supplied most of the State gold (73 percent), silver (88 percent), copper (99 percent), lead (70 percent), and zinc (76 percent) production. Output was reduced by a labor

strike which closed all mines for 2 weeks and idled the Berkeley pit operation from July 16 to September 21.

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in Silver Bow County, in terms of recoverable metals

Year	Mines producing		Material sold or treated (thousand short tons)	Gold, lode and placer (troy ounces)	Silver, lode and placer (thousand troy ounces)
	Lode	Placer			
1953–57 (average)	20	1	7,643	23,594	5,674
1958	22		10,745	17,374	3,308
1959	15	1	8,679	18,615	3,204
1960	11		12,169	21,819	2,918
1961	11	1	12,635	18,391	2,765
1962	9	1	11,654	17,657	4,027
1882–1962			(1)	2,349,000	624,960

Year	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value (thousands)
1953–57 (average)	81,175	13,444	59,566	$79,554
1958	90,557	5,492	26,580	57,942
1959	65,810	4,456	22,459	50,149
1960	91,754	1,889	4,755	63,980
1961	103,788	435	1,384	65,881
1962	93,845	4,319	28,636	70,176
1882–1962	7,739,000	402,000	2,314,000	3,626,232

[1] Data not available.

Three ore blocks were undercut at the Badger State block-caving operation (Elm Orlu-Black Rock project), and 769,074 tons of zinc ore was mined after production was initiated in March. The company announced that the planned ore production rate was to be 4,000 tons daily.

Although block-caving operations at the Kelley mine were to cease, sinking of the Kelley No. 1 shaft was continued. When completed to a depth of 4,816 feet, the shaft was to be used for centralized hoisting of copper ores from the deep levels of the Mountain Con, Steward, and Leonard mines. During 1962 the shaft was extended 810 feet. Over 32 million tons of ore had been mined from the Kelley since production began in 1952.

Other development projects in progress during the year included completion of the Steward subshaft to a depth of 4,785 feet, sinking of the Neversweat shaft from the 2800 level to the 4500 level to provide an exhaust airway for the lower levels of the Steward and Belmont mines, and preparatory work on the Kelley No. 2 shaft which when completed to the 3900 level would replace the High Ore shaft as the central pumping shaft for the Butte district.

Production from the Leonard mine was the first since 1957. The mine had been closed previously because its shaft and surface facilities were in an area to be caved by the Kelley operation. Ore production was to reach 1,400 tons daily in 1963.

The new concentrator being constructed at Butte by The Anaconda Company was to include six separate sections (units), and the building was to be large enough to permit the addition of another section if

warranted by future developments. Upon completion of a new section, equipment from a section of the old concentrator at Anaconda was to be moved to the new plant. This was to result in milling operations being carried out at both Butte and Anaconda during part of 1963 and 1964. The new concentrator was described.[14]

The Anaconda Company annual report to shareholders stated the following:

> Ore production will probably be slightly lower in 1963 because of the transfer of equipment from the concentrator at Anaconda to the new concentrator at Butte.
>
> High grade copper ores were mined from veins in the Mountain Con, Steward, and Leonard mines. Important new ore developments occurred on the lower levels of the Mountain Con and Steward mines.
>
> The Bell air compressor plant was destroyed in July by an explosion and fire. The damage was covered by insurance. There was no interruption of production because service was maintained by reserve equipment. A new 40,000 cubic foot compressor plant to replace the Bell plant is being installed at the Kelley mine.

Anaconda announced plans to construct a zinc concentrator near the Badger State mine. The plant, which would have a capacity of 4,000 tons per day, was to receive ore by belt conveyor from the Badger State mine and by rail or truck from other zinc mines in the district.

Silver ore was mined from the Carlu-Pauline and Tuxedo mines, the only mines in the district not operated by The Anaconda Company.

Phosphate rock production from the Maiden Rock mine (Victor Chemical Works) near Melrose was lower than in 1961. Elemental phosphorus was produced at the company's Silver Bow plant. Production of sand and gravel for construction purposes increased substantially.

Stillwater.—The American Chrome Co. Mouat mine, mill, and pilot smelter remained idle, and most of the company-owned homes were sold.

Toole.—Four oilfields in the county yielded 623,000 barrels of crude oil, 55,000 barrels less than in 1961. Whitlash-West joined the ranks of producing fields. Natural gas withdrawals were 964 million cubic feet. Kevin-Sunburst continued to be the major gasfield in the county.

Yellowstone.—Recovery of crude oil from the two fields in the county totaled 275,000 barrels, 35,000 barrels less than in 1961. High-purity elemental sulfur was recovered by Montana Sulphur & Chemical Co. from refinery waste gases.

The county ranked second in the State in sand and gravel production. Shale was expanded to lightweight aggregate by a company near Billings. Locally mined clay was used by Lovell Clay Products Co. to make heavy clay products. Limestone was calcined to quicklime for use at The Great Western Sugar Co. refinery.

Combined Counties.—The following counties have been combined into areas as indicated because a major oilfield or gasfield underlies parts of more than one county and its production cannot be assigned to a single county:

Daniels and Roosevelt.—Crude oil recovery from the Bredette-North field was 7,000 barrels, 4,000 barrels less than 1961.

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[14] The Northwest. Concentrator Going Up at Butte Will Stabilize Mining. May–June 1962, pp. 6–7.

Dawson, Fallon, McCone, Prairie, and Wibaux.—The Pine (4.7 million barrels) and Richey oilfields yielded 4.8 million barrels of crude oil. Production from the Pine field in 1961 was 5.2 million barrels.

Garfield and Petroleum.—Crude oil output from the Cat Creek field decreased from 239,000 barrels in 1961 to 220,000 barrels.

Glacier and Toole.—Production from the Cut Bank field was 1.9 million barrels of crude oil, compared with 2.0 million barrels in 1961. Natural gas withdrawals from Cut Bank-Reagan, the leading source of natural gas in the State, totaled 8.6 billion cubic feet. This output was considerably lower than the 12.4 billion cubic feet reported in 1961.

Golden Valley and Stillwater.—Output of natural gas from the Big Coulee field reached 953 million cubic feet, a 62 million cubic foot increase over 1961.

Musselshell and Rosebud.—The Stensvad and Bascom fields yielded 901,000 barrels of crude oil. Output from the Stensvad field was 1.5 million barrels in 1961.

Pondera and Teton.—Crude oil production from the Pondera and Pondera Coulee fields was 467,000 barrels, compared with 496,000 barrels in 1961.

The Mineral Industry of Nebraska

By Carl L. Bieniewski [1]

VALUE of mineral production in Nebraska advanced to $108.2 million, a new high for the 15th consecutive year and an increase of $2.8 million or 3 percent above that of 1961.

The mineral fuels—natural gas, natural gas liquids, and petroleum (crude)—furnished 69 percent of the total value of mineral production. Output of petroleum continued its yearly advance; the increase amounted to about one-half million barrels, the same as that of 1961. Natural gas output increased 3 percent over that of 1961. Production of LP gases and natural gasoline dropped 31 and 16 percent, respectively.

Output of nonmetals as a group accounted for the remaining 31 percent of the State total value of mineral production. Sand and gravel, cement, and stone productions increased 27, 4, and 1 percent, respectively. Productions of lime and clays declined 15 and 3 percent, respectively. Outputs of pumice and gem stones were virtually the same as in 1961.

TABLE 1.—Mineral production in Nebraska [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays—thousand short tons	146	$148	142	$142
Gem stones	(2)	5	(2)	5
Natural gas—million cubic feet	15,743	2,629	14,880	2,708
Natural gas liquids (LP gases and natural gasoline)—thousand gallons	(3)	(3)	40,957	2,138
Petroleum (crude)—thousand 42-gallon barrels	24,369	69,452	[4] 24,850	[4] 70,326
Sand and gravel—thousand short tons	10,094	8,250	12,853	9,797
Stone—do	3,622	6,324	3,670	6,626
Value of items that cannot be disclosed: Cement, lime, pumice, and value indicated by footnote [3]	----	18,637	----	16,507
Total	----	[5] 105,445	----	108,249

[1] Production as measured by mine shipments, sales, or maketable production (including consumption by producers.)
[2] Weight not recorded.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Preliminary figure.
[5] Revised figure.

[1] Mining engineer, Bureau of Mines, Denver, Colo.

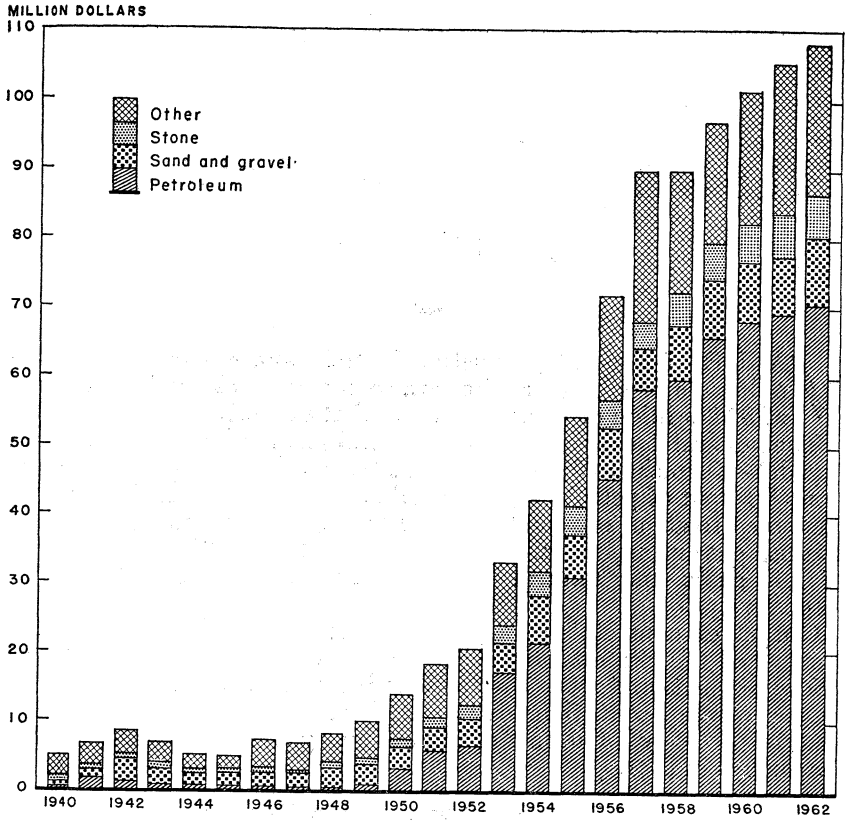

FIGURE 1.—Value of petroleum, sand and gravel, and stone, and total value of mineral production in Nebraska, 1940–62.

Some mineral production was attributed to 74 of the State's 93 counties. Production in each of nine counties was valued at over $1 million. One-fifth or $22.8 million of the State total value of mineral production came from Kimball County.

Employment and Injuries.—Table 2 shows 1961 final and 1962 preliminary employment and injury data in the State's mineral industries, exclusive of all mineral fuels except coal.

Government Programs.—The reactor of the 75,000-kilowatt sodium-cooled graphite-moderated nuclear power facility achieved criticality on August 25, 1962. The plant, built near Hallam as a cooperative project by the Atomic Energy Commission (AEC) and Consumers Public Power District of Nebraska, was not expected to be operated at full power until after mid-1963. Before the facility was to be taken to full design power, a series of experiments and operations were to be performed to verify the anticipated plant nuclear characteristics, to demonstrate the operational safety and integrity of the plant systems under nuclear conditions, to provide operational training and experience, and to confirm equipment specifications.

TABLE 2.—Employment and injuries in the mineral industries[1]

Industry	Number of operations	Average number of men employed	Total man-hours worked	Injuries		Frequency rate (injuries per million man-hours)
				Fatal	Non-fatal	
1961:						
Sand and gravel plants	221	828	1,594,735	1	20	13.2
Stone quarries and plants	72	574	1,294,659	--	14	10.8
Other: Clay and pumice mines and mills and a refinery	11	217	613,254	--	--	--
Total	304	1,619	3,502,648	1	34	10.0
1962:[2]						
Sand and gravel plants	250	1,041	2,074,520	--	27	13.0
Stone quarries and plants	68	601	1,345,228	1	24	18.6
Other: Clay and pumice mines and mills and a refinery	9	184	673,252	--	2	3.0
Total	327	1,826	4,093,000	1	53	13.2

[1] Excludes employees in all mineral fuels industries except the coal industry, as well as office workers.
[2] Preliminary figures.

Mineral receipts from rentals, including bonus considerations, and royalties from State mineral land totaled $568,387.20; oil-production royalties accounted for one-half of the mineral receipts. The State also received $9,030.46 as its share in rentals, bonuses, and royalties from mineral leasing of Federal land within the State.

Federal, State, county, and municipal funds financed many construction projects throughout the State. These projects, especially those for road building and maintenance, consumed a large part of the output of sand and gravel, crushed stone, and cement. Contracts awarded for road work in the State during the year totaled $49.5 million.[2] Of this amount, $26 million or 52 percent went for road work in the Federal-Aid Primary and Secondary (ABC) Highway System, $17.3 million or 35 percent in the National System of Interstate and Defense Highways, and $6.2 million or 13 percent in projects financed completely with State funds.

During the year, 18.3 miles of roads in the State part of the National System of Interstate and Defense Highways was completed, bringing the total number of miles open to traffic to 89.1 out of the designated 490 miles; at yearend, work was in progress on 285.8 miles.[3]

Dam and canal building by the Bureau of Reclamation, U.S. Department of the Interior, and flood control projects by the U.S. Army Corps of Engineers, were other types of construction projects that consumed raw materials in the State.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Natural Gas.—The quantity and value of natural gas production were 5 percent less and 3 percent more, respectively, than in 1961. Sixty percent of the State marketed natural gas was dry gas obtained

[2] Engineering News-Record. Road Contractors Will Set a Record. V. 170, No. 16, Apr. 18, 1963, pp. 21–24.
[3] Bureau of Public Roads. Quarterly Report on the Federal-Aid Highway Program, Dec. 31, 1962. Press Release BPR 63–10, Feb. 10, 1963.

from gas wells in Deuel, Cheyenne, and Kimball Counties. One gas discovery was reported in Cheyenne County; another, the Ibex field, was the first gas discovery in Kimball County. The remainder, or 40 percent, of the State marketed natural gas, was casing head gas from oil wells in Banner, Cheyenne, Kimball, Morrill, and Red Willow Counties. The Kansas Nebraska Natural Gas Co., Inc., laid about 120 miles of gas pipelines (8-, 10-, and 12-inch) on five projects; the largest was a 48.5-mile, 10-inch-diameter pipeline between Cambridge and Holdrege.

Natural Gas Liquids.—Output of natural gas liquids was 31 percent lower than in 1961. Natural gasoline, butane, and propane were recovered at two natural gasoline plants in Cheyenne County and one each in Banner, Deuel, and Kimball Counties. For the year average daily throughput of the five plants was 58.2 million cubic feet of natural gas.

Petroleum.—Crude petroleum output surpassed that of 1961 by about one-half million barrels, thereby continuing the upward trend started in 1949. The value of the output accounted for 65 percent of the State total value of mineral production, compared with 66 percent in 1961. Oil production was reported from 15 counties, surpassing last year's record total of 13. Kimball County with 7.7 million barrels of crude petroleum production continued to be the leading county in output. Red Willow and Banner Counties interchanged places, Red Willow taking second place, and Banner, third. Other counties reporting production of over 1 million barrels were Cheyenne, and Morrill. Crude oil production was reported for the first time for Hayes County.

Sleepy Hollow field in Red Willow County, again the largest single producing field in the State, yielded about one-fourth of the State total output of crude petroleum. The Nebraska Oil and Gas Conservation Commission conducted hearings in the latter part of the year to determine whether production from this field should be regulated.

TABLE 3.—Crude petroleum production, by counties [1]

(Thousand barrels)

County	1961	1962 [2]	Principal fields in 1962, in order of production
Banner	5,359	4,777	Willson Ranch, Singleton, Barrett, Kenmac, Vedene, Vowers, Brinkerhoff, Edwards.
Cheyenne	3,556	3,690	Juelfs-Gaylord, Cook, Doran, West Frei, North Faro, Reimers.
Dundy	31	26	Highland, Pierce Lake, East Indian Creek.
Frontier	2	3	Spring Creek, Sand Creek.
Furnas	6	3	Beaver Creek.
Garden	10	10	Richards, McCord.
Harlan	110	82	South Alma.
Hayes	----------	7	Blackwood Creek.
Hitchcock	261	193	Reiher, Culbertson, Bush Creek.
Kimball	8,951	7,668	Sloss, Kimball, Enders, Jacinto, Southwest Potter, Griffith.
Lincoln	----------	11	Red Willow Creek.
Morrill	1,232	1,247	Olsen, Waitman, Lane, Lindberg.
Red Willow	4,624	6,973	Sleepy Hollow, Silver Creek, Ackman.
Richardson	181	127	Dawson, Barada, Falls City.
Scotts Bluff	46	33	Vessels, Roubadeau.
Total	24,369	24,850	

[1] Based on county data in Annual Oil Issue published by Division of Nebraska Resources; data are adjusted to Federal Bureau of Mines total.
[2] Preliminary figures.

At yearend the matter was still under consideration. The Sloss field in Kimball County was the only other field with production of 1 million barrels or more. Reportedly, 50 of the 306 active oil-well fields, including the Sleepy Hollow and Sloss fields, had production of over 100,000 barrels.

TABLE 4.—Wildcat- and development-well completions in 1962, by counties

County	Crude	Gas	Dry	Total	Footage	County	Crude	Gas	Dry	Total	Footage
Wildcat:						Wildcat—Continued					
Arthur	------	-----	3	3	14,900	Perkins	------	----	7	7	35,000
Banner	8	-----	33	41	248,100	Phelps	------	----	2	2	8,600
Box Butte	------	-----	5	5	23,300	Red Willow	2	----	31	33	124,500
Buffalo	------	-----	4	4	15,700	Rock	------	----	6	6	------
Chase	------	-----	2	2	8,100	Scotts Bluff	------	----	10	10	53,400
Cherry	------	-----	1	1	4,300	Sheridan	------	----	3	3	9,500
Cheyenne	6	1	35	42	211,600	Sioux	------	----	2	2	8,600
Custer	------	-----	15	15	56,000	Thomas	------	----	1	1	3,900
Dawson	------	-----	9	9	32,600	Total	25	2	387	414	1,899,800
Deuel	------	-----	2	2	7,500	Development:					
Dundy	------	-----	1	1	4,600	Banner	31	----	[1]33	64	387,300
Franklin	------	-----	2	2	8,300	Cheyenne	8	2	15	25	129,800
Frontier	1	-----	17	18	68,600	Dundy	------	----	1	1	4,500
Furnas	------	-----	11	11	39,600	Furnas	------	----	1	1	3,400
Garden	------	-----	5	5	17,700	Frontier	------	----	1	1	4,300
Garfield	------	-----	4	4	12,600	Harlan	2	----	3	5	17,700
Gosper	------	-----	5	5	19,200	Hayes	1	----	2	3	14,200
Grant	------	-----	1	1	5,200	Hitchcock	1	----	2	3	12,700
Harlan	------	-----	1	1	4,400	Kimball	19	1	[1]36	56	346,800
Hayes	------	-----	9	9	41,000	Lincoln	1	----	5	6	27,600
Hitchcock	1	-----	10	11	49,100	Morrill	8	----	6	14	68,100
Holt	------	-----	5	5	2,500	Red Willow	77	----	21	98	349,800
Keith	------	-----	7	7	33,200	Total	148	3	[1]126	277	1,366,200
Kimball	5	1	52	58	373,000	Total all drilling	173	5	[1]513	691	3,266,000
Lincoln	1	-----	37	38	143,100						
Logan	------	-----	5	5	19,900						
Loup	------	-----	6	6	9,500						
McPherson	------	-----	11	11	48,100						
Morrill	1	-----	27	28	134,600						

[1] Includes one service-well completion.

Source: Oil and Gas Journal.

Ten new secondary-recovery projects were approved by the Nebraska Oil and Gas Conservation Commission. The 61 active projects accounted for 7 million barrels of oil or about 28 percent of the State output.

Drilling took a sharp drop; 691 wells were completed, compared with the record high of 1,005 in 1961. The Cambridge Arch and Denver-Julesburg Basin areas both shared in the decline. Of the 277 development wells completed, 151 or 55 percent were successful. Red Willow County had the largest number of development wells drilled and the largest number of successful development wells (98 and 77, respectively). Of the 414 wildcat wells drilled in the State, 27 were discovery wells, for a success ratio of 1:15. Although Kimball led the counties in the State by having the largest number (58) of wildcat completions, Banner had the largest number (8) of successful wildcat wells.

One of the most significant oil discoveries was the Canal field (sec. 24, T. 21 N., R. 55 W.) in Scotts Bluff County.[4] Initial production of the field was 250 barrels of oil per day. Wildcat wells were drilled in

[4] Reed, E. C. Nebraska Oil Production Climbs in 1962. Nebraska on the March Annual Oil Issue, v. 15, No. 4, April 1963, p. 2.

Holt, Garfield, Loup, and Rock Counties, an area of the State previously unexplored; none of the wells was successful. About $18 million was spent on drilling, all by rotary rigs. The average depth of the development wells in the State in 1962 was 4,932 feet and that of wildcat wells, 4,589 feet. The number of rigs operating at any one time varied from 6 to 27.

Cooperative Refinery Association operated its skimming and cracking refinery at Scottsbluff throughout the year. Oilfields in southeastern Wyoming and Banner County were the sources of crude petroleum for the plant. Throughput for the year was 946,747 barrels of crude oil, an increase of 34,000 barrels or 4 percent over that of 1961.

NONMETALS

Cement.—Shipments of cement, all from two plants (Ash Grove Lime & Portland Cement Co. at Louisville and Ideal Cement Co. at Superior), were 4 percent more than in 1961. Eighty percent of the cement shipped was consumed in the State and 20 percent in nearby States. Portland cement shipments constituted 98 percent of the total shipments and masonry cement shipments 2 percent. The annual average price of portland cement increased from $3.43 per barrel (376 pounds) in 1961 to $3.48; masonry cement dropped from $3.30 per barrel (280 pounds) to $3.23. Ready-mixed concrete companies purchased 55 percent of the portland cement shipped; other buyers, in order of quantity purchased, were highway contractors, building-material dealers, concrete-product manufacturers, other building contractors, and miscellaneous customers.

Clays.—Output of clays, all by the same five producers as in 1961, decreased 4,000 tons or 3 percent below that of last year. Clay mined by Ash Grove Lime & Portland Cement Co. from a pit near its plant was used for producing cement. Output by Omaha Brick Works in Douglas County, Endicott Clay Products Co. in Jefferson County, Yankee Hill Brick Manufacturing Co. in Lancaster County, and Western Brick and Supply Co. in Otoe County was used in the respective company plants for making heavy clay products.

Gem Stones.—The value of the gem materials collected was $5,000, the same as in 1961. Agate, calcite, chalcedony, and petrified wood were the main gem materials gathered by individuals, rock shops, and various gem and mineral societies.

Lime.—Production of lime was less than in 1961. Quicklime, representing all of the lime output, was produced at four sugar beet plants—Gering, Mitchell, Scottsbluff, and Bayard—of The Great Western Sugar Co. and at one plant—Grand Island—of American Crystal Sugar Co. for use in extracting sugar from sugar beets.

Perlite.—Crude perlite, shipped from New Mexico and Nevada to the Omaha plant of Western Mineral Products Co., was expanded for use in building plaster and concrete.

Pumice.—Crude pumice mined at the LeMaster mine was processed at the Callaway plant of LaRue-Axtell Pumice Co. The prepared pumice was used for manufacturing cleansers and abrasives.

Sand and Gravel.—The output of 12.9 million tons of sand and gravel surpassed the previous high of 11.2 million tons, established in 1959.

Production increased nearly 2.8 million tons or 27 percent in quantity and $1.5 million or 19 percent in value over that of 1961. Most of the increase resulted from a larger volume of road construction than in 1961. Fifty-six percent of the output of sand and gravel was used for road construction; 33 percent for building construction; and 7 percent for fill, engine sand, and railroad ballast. No specific uses were reported for the remaining 4 percent, or 500,000 tons of sand and gravel. Of the 191 active operations, the 168 classified as commercial had a combined production of 11.0 million tons; the 23 government-and-contractor operations had 1.9 million tons. In 66 of the State's 93 counties sand and gravel was produced. Two counties, Douglas and Dodge, each had production exceeding 1 million tons. Commercial operators, each with production of 100,000 tons or more, were Ace Sand & Gravel Co.; Behrens Construction Co.; W. A. Biba Engineering Co.; Central Sand & Gravel; Christensen Sand & Gravel Co.; Consolidated Sand & Gravel Co.; Einung Sand & Gravel Co.; East Ashton Sand Co.; Elkhorn Construction Co.; Gayman Sand & Gravel; H & M Equipment Co., Inc.; Johnson Aggregate Co.; Lincoln Sand & Gravel Co.; C. H. Luther; Luther & Maddox Gravel Co.; Lyman-Richey Sand & Gravel Corp.; McCann Sand & Gravel Co.; Nichols Construction Co.; Overland Sand & Gravel Co.; Sawyer Sand & Gravel Co.; Western Sand & Gravel Co.; and Wolf Sand & Gravel Co.

TABLE 5.—Sand and gravel production in 1962, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Adams	65	$48	Keith	112	$73
Antelope	69	44	Kimball	7	10
Banner	10	5	Knox	166	102
Boone	(1)	(1)	Lancaster	30	9
Boyd	(1)	(1)	Lincoln	417	276
Brown	(1)	(1)	Loup	41	24
Buffalo	753	483	Madison	576	425
Butler	223	167	Merrick	149	142
Cass	806	616	Morrill	(1)	(1)
Cedar	145	118	Nance	151	143
Cherry	23	49	Nuckolls	30	15
Cheyenne	(1)	(1)	Pawnee	(1)	(1)
Clay	147	137	Perkins	53	11
Colfax	104	87	Phelps	152	82
Cuming	137	120	Pierce	112	97
Custer	(1)	(1)	Platte	475	493
Dawson	295	189	Polk	80	80
Dixon	30	39	Red Willow	107	92
Dodge	1,037	773	Richardson	(1)	(1)
Douglas	1,040	1,050	Saline	165	123
Fillmore	84	60	Sarpy	861	857
Franklin	(1)	(1)	Saunders	462	364
Frontier	18	17	Scotts Bluff	83	48
Furnas	61	49	Sheridan	1	(2)
Gage	149	135	Sioux	25	13
Garden	71	28	Stanton	119	118
Greeley	18	14	Thayer	263	205
Hall	811	371	Thomas	(1)	(1)
Hamilton	68	68	Valley	37	28
Harlan	81	47	Webster	(1)	(1)
Hayes	(1)	(1)	York	85	78
Hitchcock	32	22	Undistributed	1,353	871
Holt	92	64			
Jefferson	210	148	Total	12,853	9,797
Kearney	162	70			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Less than $500.

TABLE 6.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Construction:				
Building	2,005	$1,747	3,113	$2,701
Paving	851	716	1,048	822
Railroad ballast	(1)	(2)		
Fill	251	119	(3)	(3)
Other	9	8	225	129
Industrial:				
Engine			1	(2)
Other	(3)	(3)		
Total	3,116	2,590	4,387	3,652
Gravel:				
Construction:				
Building	2,145	1,809	1,043	851
Paving	3,617	2,903	5,054	3,752
Fill	12	8	7	5
Other	83	58	117	80
Miscellaneous	126	108	330	269
Total	5,983	4,886	6,551	4,957
Total sand and gravel	9,099	7,476	10,938	8,609
Government-and-contractor operations:				
Sand:				
Building	(1)	(2)	18	43
Paving	227	110	390	198
Fill	70	14		
Total	297	124	408	241
Gravel:				
Building	26	25	4	3
Paving	616	569	692	540
Fill	56	56	811	404
Total	698	650	1,507	947
Total sand and gravel	995	774	1,915	1,188
All operations:				
Sand	3,413	2,714	4,795	3,893
Gravel	6,681	5,536	8,058	5,904
Total	10,094	8,250	12,853	9,797

[1] Less than 500 short tons.
[2] Less than $500.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Other" construction sand.

Stone.—The entire output of stone, 3.7 million tons, virtually the same as in 1961, was crushed and broken limestone except for 1,200 tons of dimension limestone. One-half of the crushed limestone was used in concrete and as roadbase; the remainder was used for producing cement and as riprap, agricultural-lime rock, and filling agent. Commercially classified stone produced by 20 companies with 27 operations totaled 3.4 million tons; noncommercially classified stone produced for 5 governmental agencies totaled 0.3 million tons. Commercial stone producers, each with production of 100,000 tons or more, were Ash Grove Lime & Portland Cement Co.; City Wide Rock and Excavation Co.; Fort Calhoun Stone Co.; Hopper Bros. Quarries; Missouri Valley Limestone Co., Inc.; Nelson Quarries, Inc.; United Mineral Products Co.; and Welsh Stone Co., Inc. Slightly over one-

half of the total output came from Cass County. Stone production also was reported in 12 other counties.

TABLE 7.—Stone sold or used by producers, by uses

Use	1961		1962	
	Short tons	Value	Short tons	Value
Dimension stone: Rubble			1,200	$1,980
Crushed and broken stone:				
Riprap	849,931	$1,133,424	792,920	1,127,678
Refractory	(1)	(1)		
Concrete and roadstone	1,575,038	2,882,499	1,758,346	3,078,408
Agriculture	140,244	235,334	124,585	198,616
Other	[2] 1,056,502	[2] 2,072,359	[3] 993,415	[3] 2,219,222
Total	3,621,715	6,323,616	3,669,266	6,623,924
Total stone	3,621,715	6,323,616	3,670,466	6,625,904

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes stone used in asphalt filler, cement, drain filter, feed, paint, and rubber filler.
[3] Includes stone used in asphalt filler, cement, feed, mineral filler, paint, and rubber filler.

Talc.—Sierra Talc Co. processed crude talc from out-of-State sources at its Grand Island grinding plant. The material was ground for use in ceramics, paint, paper, rubber, textiles, and cosmetics; a part of the processed talc was shipped outside the United States.

Vermiculite.—At its Omaha plant, Western Mineral Products Co. exfoliated crude vermiculite from Montana. The processed vermiculite was sold for use as loose-fill insulation material, litter, and as an aggregate in plaster and acoustical material.

METALS

Although no metals were mined in Nebraska, lead bullion and other lead-bearing materials from smelters outside the State were treated at the American Smelting and Refining Co. (Asarco) silver-lead refinery in Omaha. In addition to refined lead and silver, antimonial lead, antimony, bismuth, and other byproduct metals were produced.

REVIEW BY COUNTIES

Only those counties with significant mineral production and mineral industry activity are discussed in this review; see table 8 for additional details.

Banner.—A 600,000-barrel drop in petroleum output was the main reason that the total value of mineral production was $2.1 million below that of 1961. Outputs of three commodities—petroleum, natural gas liquids, and sand and gravel—were less than in the previous year; natural gas output was greater. Petroleum accounted for 93 percent of the total value of mineral production. The output, 4.8 million barrels, was produced from 60 fields. The Willson Ranch field, yielding 590,000 barrels, was again the largest-producing field in the county; it also had the largest drop (257,000 barrels) in output compared with the 1961 production. Nearly offsetting the drop in output from the Willson Ranch field was the increase (227,000 barrels) from the

Kenmac field. Other fields, each with a production of over 100,000 barrels, were Barrett, Brinkerhoff, Edwards, Lewis, Ludden, Raymond, Singleton, Vedene, and Vowers. The total production of these 11 fields accounted for 75 percent of the oil output in the county.

TABLE 8.—Value of mineral production, by counties[1]

County	1961	1962[2]	Minerals produced in 1962, in order of value
Adams	$30,500	$48,000	Sand and gravel.
Antelope	77,200	43,500	Do.
Banner	[3] 16,616,400	14,490,000	Petroleum, natural gasoline, natural gas, LP gases, sand and gravel.
Boone	(4)	(4)	Sand and gravel.
Boyd	(4)	(4)	Do.
Brown	28,700	(4)	Do.
Buffalo	213,800	483,400	Do.
Butler	73,500	167,100	Do.
Cass	16,506,662	16,202,702	Cement, stone, sand and gravel, clays.
Cedar	137,900	118,400	Sand and gravel.
Cherry	3,396	234,700	Stone, sand and gravel.
Cheyenne	[3] 12,345,000	12,612,000	Petroleum, natural gas, LP gases, sand and grave
Clay	53,300	137,300	Sand and gravel.
Colfax	69,800	87,200	Do.
Cuming	110,100	119,800	Do.
Custer	100,730	51,055	Pumice, sand and gravel.
Dawes	[3] 280	165	Gem stones.
Dawson	155,400	189,100	Sand and gravel.
Deuel	[3] 716,000	667,000	Natural gas, LP gases.
Dixon	178,776	(4)	Sand and gravel, stone.
Dodge	870,200	773,200	Sand and gravel.
Douglas	[3] 860,200	1,053,200	Sand and gravel, clays.
Dundy	88,000	74,000	Petroleum.
Fillmore	56,200	59,800	Sand and gravel.
Franklin	51,230	(4)	Do.
Frontier	25,900	25,600	Sand and gravel, petroleum.
Furnas	92,600	58,400	Do.
Gage	222,115	273,419	Stone, sand and gravel.
Garden	59,275	56,300	Sand and gravel, petroleum.
Gosper	500		
Greeley	15,600	14,000	Sand and gravel.
Hall	438,683	(4)	Sand and gravel, lime.
Hamilton	57,400	68,100	Sand and gravel.
Harlan	314,000	279,100	Petroleum, sand and gravel.
Hayes	(4)	27,200	Do.
Hitchcock	782,700	567,500	Do.
Holt	16,000	64,300	Sand and gravel.
Jefferson	206,603	(4)	Sand and gravel, clays.
Kearney	94,200	69,800	Sand and gravel.
Keith	50,200	73,200	Do.
Kimball	[3] 26,758,000	22,771,900	Petroleum, natural gas, natural gasoline, LP gases, sand and gravel.
Knox	137,200	102,325	Sand and gravel, gem stones.
Lancaster	280,602	226,302	Stone, clays, sand and gravel.
Lincoln	140,900	307,200	Sand and gravel, petroleum.
Loup	52,400	24,000	Sand and gravel.
Madison	155,200	424,800	Do.
Merrick	30,100	142,200	Do.
Morrill	[3] 3,682,300	3,708,100	Petroleum, sand and gravel, natural gas, lime
Nance	16,800	142,700	Sand and gravel.
Nemaha	(4)	(4)	Stone.
Nuckolls	(4)	(4)	Cement, sand and gravel.
Otoe	79,355	(4)	Clays.
Pawnee	(4)	101,515	Stone, sand and gravel.
Perkins	21,000	10,600	Sand and gravel.
Phelps	44,500	82,100	Do.
Pierce	57,300	96,700	Do.
Platte	875,200	93,000	Do.
Polk		9,900	Do.
Red Willow	[3] 13,285,400	19,863,400	Petroleum, sand and gravel, natural gas.
Richardson	597,187	409,581	Petroleum, stone, sand and gravel.
Saline	38,000	123,000	Sand and gravel.
Sarpy	1,088,286	1,336,023	Sand and gravel, stone, gem stones.
Saunders	168,900	939,852	Stone, sand and gravel.
Scotts Bluff	405,400	356,279	Lime, petroleum, sand and gravel.
Seward	(4)	(4)	Stone.
Sheridan	2,800	300	Sand and gravel.
Sioux	(4)	13,800	Sand and gravel, gem stones.

See footnotes at end of table.

TABLE 8.—Value of mineral production, by counties[1]—Continued

County	1961	1962[2]	Minerals produced in 1962, in order of value
Stanton	70,400	118,300	Sand and gravel.
Thayer	96,100	205,100	Do.
Thomas	----------	(4)	Do.
Thurston	(4)	(4)	Stone.
Valley	31,300	28,000	Sand and gravel.
Washington	(4)	(4)	Stone, gem stones.
Webster	(4)	(4)	Sand and gravel.
York	35,800	78,100	Do.
Undistributed[5]	[3] 5,575,032	6,875,177	
Total	[3] 105,445,000	108,249,000	

[1] The following counties are not listed because no production was reported: Arthur, Blaine, Box Butte, Burt, Chase, Dakota, Garfield, Grant, Hooker, Howard, Johnson, Keya Paha, Logan, McPherson, Rock, Sherman, Wayne, and Wheeler.
[2] Value of petroleum is preliminary.
[3] Revised figure.
[4] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[5] Includes some sand and gravel and gem stones that cannot be assigned to specific counties and values indicated by footnote 4.

Exploration activity was less than in 1961; 41 wildcat wells were drilled compared with 73 in 1961. The wildcat drilling in 1962 resulted in eight oil discoveries. Thirty-one of the 64 development wells drilled were successful. The county led all others in development footage drilled, 387,300 feet. At the Banner natural gasoline plant of Antelope Gas Products Co., casing head gas from oilfields within the county was processed for producing natural gas, LP gases, and natural gasoline.

Banner County Highway Department produced about 10,000 tons of sand for road maintenance.

Cass.—The value of the cement, clays, sand and gravel, and stone produced was $16.2 million or 15 percent of the State total value of mineral production. The county, which was ranked second last year, was third in value of mineral production. The county continued to be the leading producer of cement, clays, and stone.

Ash Grove Lime & Portland Cement Co. produced portland and masonry cements at its Louisville cement plant throughout the year. The company mined limestone and shale (clay) from deposits near the plant for use in making the cements. Other stone producers were Heebner Quarries; Hopper Bros. Quarries; Missouri Valley Limestone Co., Inc.; Schwarck Quarries, Inc.; United Mineral Products Co.; and Welsh Stone Co., Inc. Stone production of Schwarck Quarries, Inc., came from a quarry reopened by the company in October. Lyman-Richey Sand & Gravel Corp. and Western Sand & Gravel Co. produced sand and gravel.

Cheyenne.—Twelve percent of the State total value of mineral production was produced in Cheyenne County. Value of petroleum output accounted for 83 percent of the county total. One gas and 6 oil discoveries resulted from drilling 42 wildcat wells; all discoveries were in the J sandstone (Cretaceous) formation. Of the 25 development wells drilled, 8 were crude oil producers, and 2 were gas producers. The total footage of the 42 completed wildcat wells drilled was 211,600 feet; that of the 25 development wells was 129,800 feet.

Natural gas and natural gas liquids (LP gases and natural gasoline) were produced at the Huntsman and West Sidney gas-processing plants of Marathon Oil Co. (formerly Ohio Oil Co.). The feed for the two plants was casing head gas from oilfields in Banner and Cheyenne Counties and dry natural gas from gasfields in Cheyenne County.

Ready-Mix Concrete Co. produced some gravel for use in concrete.

Deuel.—Kansas-Nebraska Natural Gas Co., Inc., at its Big Springs gas-processing plant, recovered natural gas and natural gas liquids from dry natural gas obtained from the Big Springs gasfield and casing head gas from nearby oilfields.

Dodge.—Although sand and gravel production was 24,000 tons more than that of last year, the county dropped from first to second place in the State in output. Six commercial sand and gravel producers—Christensen Sand & Gravel Co., Cowles Gravel Co., Cuming County Gravel Co., Lincoln Sand & Gravel Co., Lux Sand & Gravel Co., and Lyman-Richey Sand & Gravel Corp.—accounted for all of the mineral output in the county.

Douglas.—Virtually all of the value of mineral production in the county was attributed to sand and gravel production. Douglas replaced Dodge as the leading county in output of sand and gravel. The difference in outputs between Douglas and Dodge was 2,200 tons, a relatively small quantity considering that each county produced over 1 million tons. Acme Sand & Gravel Co.; Hartford Sand & Gravel Co.; Johnson Aggregate Co.; Lyman-Richey Sand & Gravel Co.; McCann Sand & Gravel Co.; and Ready Sand & Gravel, Inc., all classified as commercial producers, accounted for the entire output of sand and gravel in the county. Clay was mined by Omaha Brick Works for use in making heavy clay products.

Crude perlite and crude vermiculite from out-of-State sources were processed at the Western Minerals Products Co. expanding plant in Omaha. From lead bullion and other lead-bearing material obtained from smelters outside the State, Asarco produced refined lead and other byproduct metals at its lead-silver refinery in Omaha.

Hayes.—Oil was produced for the first time in the county; production came from 1 discovery among the 10 wildcat wells drilled.[5] The successful wildcat well hit oil in the Basal sand (Pennsylvanian) formation. Krotter Bros. produced gravel at Palisade.

Hitchcock.—The $215,000 decline in value of mineral production resulted primarily from a $198,000 drop in value of petroleum output. The Reiher oilfield production, 173,000 barrels or 90 percent of the county output, was 74,000 barrels below that of 1961. The balance of the petroleum production, 20,000 barrels, was obtained from six fields. One successful wildcat well out of 11 drilled hit oil in the Lansing (Pennsylvanian) formation. One of the three development wells completed was an oil producer.

Sand and gravel output, 13,000 tons below that of 1961,was produced by Buzzell Gravel Co. and Daisy Trask Gravel.

Kimball.—Although the value of mineral production declined $4 million below that of 1961, Kimball again was the county with the greatest value of mineral output in the State. In addition, it con-

[5] Work cited in footnote 4.

tinued to hold first place in producing petroleum although output dropped 1.3 million barrels. Value of mineral production ($22.8 million) represented about one-fifth of the total value in the State. Petroleum output of 7.7 million barrels was produced from about 700 wells operated in 124 oilfields. The Sloss field, the largest producing oilfield in the county, with an output of nearly 1.5 million barrels, was one of two fields in the State to produce more than 1 million barrels. Other large producing fields in the county were the Brook, Dietz, Enders, Fernquist, Griffith, Heidemann, Hill, Hoffman, Houtby, Long, Ostgren, Potter-SW, Riggs, Russell, Simpson, and Travis (Jacinto); oil output from each of these fields was between 100,000 and 500,000 barrels. The Sloss field had the largest increase in output, about 155,000 barrels, and the Travis (Jacinto) field the largest decrease, about 193,000 barrels.

Kimball led all other counties in the State in exploration activity, measured in number of wildcat wells completed and total footage drilled. The 58 wildcat wells completed resulted in 5 oil discoveries and 1 gas discovery; the total footage drilled was 373,000. The producing zone of the oil discoveries was in the J sandstone (Cretaceous) formation. The No. 1 Furst well was the first significant gas discovery in the county. The gasfield, discovered in the D sandstone (Cretaceous) formation, was named the Ibex field. Initial daily production of the discovery well was 14.4 million cubic feet of gas. Of the 56 development wells completed, 19 were oil producers and 1 was a gas producer. The footage drilled for all the development wells totaled 347,000.

Natural gas and natural gas liquids were recovered from casing head gas at the Kimball plant of Antelope Gas Products Co.

Wilson Bros., Inc., produced gravel from an operation near Kimball.

Morrill.—The value of mineral production and the output of petroleum were virtually the same as in 1961. The value of petroleum production accounted for 95 percent of the county value; the output, 1.2 million barrels, was obtained from 14 fields. The Olsen field, with an output of nearly 380,000 barrels, was the largest producer. The Lane, Lindberg, and Waitman fields each produced more than 100,000 barrels.

The No. 1 Durland-Trust well was the only successful wildcat well out of the 28 drilled. The producing zone of the oil discovery was in the J sandstone (Cretaceous) formation. Eight of the 14 development wells completed were oil producers. Total footage drilled for all of the wildcat wells was 134,600; for all the development wells, 68,100.

Casing head gas from oilfields was piped to gas processing plants outside the county for recovery of natural gas.

Lime was produced at the Bayard plant of The Great Western Sugar Co. for use in making sugar from sugar beets. Lyman-Richey Sand and Gravel Corp. produced sand and gravel at its Bridgeport plant.

Nuckolls.—Ideal Cement Co. produced portland and masonry cements at its Superior cement plant. Construction of the new storage and bulk-loading facilities at the plant was to be completed in 1963. C. F. Bondegard produced sand and gravel from an operation at Ruskin.

Red Willow.—A $6.6 million increase in petroleum production over that of 1961 advanced the county from fourth place to second place in total value of mineral production. Petroleum accounted for $19.7 million or 99.3 percent of the value of mineral production. The output of nearly 7 million barrels was 2.3 million barrels over that of 1961. The Sleepy Hollow field, with an output of 5.8 million barrels, was the largest producing field in the State, surpassing the second largest, Sloss field in Kimball County, by 4.4 million barrels. The Sleepy Hollow field yielded 2.1 million barrels more than in 1961. At yearend, regulation of production from this field was under consideration by the Nebraska Oil and Gas Conservation Commission. The Silver Creek field, with an output of 601,000 barrels, 264,000 barrels more than in 1961, was the third largest producing field in the county. Output of the Ackman field was 358,000 barrels, 177,000 barrels below that of 1961. The Midway field, discovered in 1961, had production of 118,000 barrels. In addition, six fields each had production of less than 25,000 barrels.

Exploration and development drilling dropped below that of 1961; 33 wildcat wells and 98 development wells were completed, compared with 103 and 237, respectively, in 1961. Two of the wildcat wells resulted in oil discoveries, and 77 of the development wells were oil producers. The producing zone of the two oil discoveries was in the Lansing-Kansas City (Pennsylvanian) formation. Total footage drilled for the wildcat wells was 124,500; for the development wells, 349,800.

Natural gas was recovered from casing head gas from oilfields within the county. Sand and gravel was produced by four commercial operators; they were Davidson-Merritt Sand & Gravel Co., Gillen Sand & Gravel Co., McCook Sand & Gravel Co., and Midwest Sand & Gravel Co.

Richardson.—A decrease of $188,000 was reported for the county value of mineral production. Following an upward trend for the past 2 years, petroleum production dropped in 1962; total output of the three active oilfields, Barada, Dawson, and Falls City, was 54,000 barrels below that of 1961. Sand and gravel output also declined; only Harmon Gravel Co., a commercial operator, had production. No production was reported by the Government-and-contractor operation active in 1961. Stone production increased but not enough to offset the combined decreases in value of output of petroleum and sand and gravel. Findlay Quarries and the Richardson County Highway Department produced crushed limestone.

Sarpy.—Sand and gravel production represented two-thirds of the value of mineral production, and stone, one-third. The output of sand and gravel came from four operations by Lyman-Richey Sand & Gravel Corp. and one operation each by Johnson Sand & Gravel Co. and Richfield Sand & Gravel Co. The stone, which consisted of crushed limestone, was produced by City Wide Rock & Excavation Co.; Stone Products, Inc.; and Welsh Stone Co., Inc. A small quantity of calcite mineral specimens of nominal value was collected.

Saunders.—The total value of the two mineral commodities produced in the county was nearly $1 million. Stone production came from a limestone quarry operated by Hopper Bros. Quarries. Lyman-Richey

Sand & Gravel Corp. and Wolf Sand & Gravel Co., each with two operations, and Morse Bluff Sand and Gravel Co. and W. A. Biba Engineering Co., each with one operation, produced the entire output of sand and gravel.

Scotts Bluff.—The county value of mineral production was $50,000 below that of 1961. Of the three commodities produced, only sand and gravel increased in production. Petroleum and lime each had a decreased output.

Lime output, the largest contributor to the county value, was produced at the Gering, Mitchell, and Scottsbluff sugar plants of The Great Western Sugar Co. for use in sugar refining.

Petroleum production dropped from 46,000 barrels in 1961 to 33,000 barrels primarily because of a combined decline of 15,000 barrels output from the Vessels and Roubadeau fields. A new discovery, the Canal field,[6] had a production of 3,000 barrels. This new field was significant because it was one of the most northerly fields discovered in the Denver-Julesburg Basin area in the State. Initial production of 250 barrels of oil per day compared favorably with output from the producing wells in the Southern Panhandle. Ten other exploration wells drilled were dry holes. No development wells were drilled. Cooperative Refinery Association operated its oil refinery at Scottsbluff. Crude petroleum was piped to the plant from oilfields in southeastern Wyoming and Banner County.

Three commercial operators—Eisele Concrete Products; Harry F. Berggren & Sons, Inc.; and Willis Young—and one Government-and-contractor operator—the Scotts Bluff County Highway Department (work done by contractors)—produced sand and gravel.

Washington.—Virtually all of the county value of mineral production was derived from the limestone quarry operated by Fort Calhoun Stone Co. Production was large enough to rank the county second in quantity of stone produced. The balance of the value of mineral production was derived from the pyrite mineral specimens collected.

[6] Work cited in footnote 4.

The Mineral Industry of Nevada

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Nevada Bureau of Mines for collecting information on all minerals except fuels.

By L. E. Davis,[1] Roy Y. Ashizawa,[2] and L. Giorgetti[3]

MINERAL production value for Nevada in 1962 was $83.7 million, a rise of less than 3 percent from 1961. The nonmetallic minerals group, especially sand and gravel, was responsible for most of the $2.2 million gain. The metals group increased less than 1 percent in value, and petroleum production dropped more than 8 percent in value.

Producers of iron ore and concentrates, magnesite and magnesium compounds, and crude perlite reported a relatively good export trade but at a rate noticeably reduced from 1961.

In July, Getchell Mine, Inc., began bullion shipments from its new gold ore treatment plant in Humboldt County. New lessees took over the operation of iron deposits on Southern Pacific Co. land in Pershing County. The Anaconda Company operated its sulfide concentrator at Weed Heights, Lyon County, for a full year, contributing notably to Nevada's increased copper output; the company also reported the purchase of the Mt. Wheeler beryllium deposit in the Snake Range, White Pine County. Nevada Scheelite Division, Kennametal, Inc., completed a plant at Fallon, Churchill County, for refining tungsten carbide produced at its Mineral County operation. In May, Standard Slag Co. sold its magnesite processing facilities at Gabbs, Nye County, and leased its mining claims to Basic, Inc. Standard Slag also began shipments of iron concentrates (sinter grade) from its new mill near Yerington, Lyon County, established a testing laboratory in Sparks, Washoe County, and explored the Stoker kaolin deposit east of Lovelock, Pershing County.

Exploration and development work was at a relatively high level. The U.S. Geological Survey Circular 475, "Mineralization Associated With a Magnetic Anomaly in Part of the Ely Quadrangle, Nevada," stimulated claim staking and exploration for copper, lead, and silver ores on the east slope of Ward Mountain, White Pine County, by major mining companies and numerous individuals. In Clark County, Beryllium Associates continued exploration and de-

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velopment at the Leavitt beryllium claims south of Mesquite; Homestake Mining Co. investigated the Crescent Peak area for copper ores; and west of Mesquite the Leavitt Bros. explored a gypsum deposit. Danite Mining & Exploration Co. explored the Mammouth mine, Douglas County, for silver ore. Newmont Exploration, Ltd., began extensive exploration for silver in western Elko County, and Callahan Mining Corp. explored a silver-bearing deposit in Esmeralda County by drilling. Baroid Division, National Lead Co., started construction of a plant at Dunphy, Eureka County, to process crude barite from its Rossi mine; Siskon Corp. continued exploration of the Gibellini vanadium property south of Eureka; and American Colloid Co. acquired claims and explored a perlite deposit in northern Eureka County. Exploration for gold ore was conducted by Kerr-McGee Oil Industries and Newmont Exploration, Ltd., in the Goldacres area, and Duval Sulphur & Potash Co. continued its exploration program for copper in the Copper Canyon-Copper Basin area, Lander County. Newmont and Hidden Splendor Mining Co. completed an exploration project for copper, lead, and silver in the Pioche district; McKinney Mines, Inc., began major underground exploration at the Atlanta gold-silver mine in the Atlanta district; and Wells Cargo, Inc., explored the Tule Valley gypsum deposit near Carp, Lincoln County. Lyon County iron deposits were under continuous exploration by Utah Construction & Mining Co. and Columbia Iron Mining Co. American Metal Climax Co. explored for molybdenum in an area near Mina, Mineral County. In Nye County, diamond drilling by The Anaconda Company was in progress at the Hall molybdenum property northeast of Tonopah; Hays Development Co. acquired the A&B mercury mine in the Warm Springs district and began exploration; and drilling operations were underway at the Nevada Porphyry property near Manhattan, Nye County. Bear Creek Mining Co. continued exploring for copper in the Ruth area of the Robinson district, and Umont Mining, Inc., explored for lead ore in the Hamilton district, White Pine County.

Employment and Injuries.—According to statistics collected and compiled by the Federal Bureau of Mines, in cooperation with the Nevada State Inspector of Mines, both employment and the man-hours worked dropped 13 and 17 percent, respectively, compared with 1961.

There were four fatal injuries, the same as in 1961, and all occurred at metal mines. Fewer nonfatal injuries were reported. The ratio of man-hours worked to total employment remained virtually unchanged, but the injury frequency rate increased. Three of the fatalities occurred at mines in White Pine County. One worker was struck on the head by a falling rock, another died when a bulldozer overturned, crushing the driver, and a third man was killed when he either jumped or was thrown from a front end loader while operating the vehicle. The fourth fatality happened when an employee was pulled into the tail pulley of a conveyor in a crushing plant at a Lyon County mine.

The Nevada Employment Security Department reported average weekly earnings for the mining industry at $122.84, up from $116.89 in 1961, for a workweek that averaged 1 hour more than 1962.

TABLE 1.—Mineral production in Nevada [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite—short tons	129,524	$863	137,727	$954
Copper (recoverable content of ores, etc.)—do	78,022	46,813	82,602	50,883
Fluorspar—do	18,129	357	(2)	(2)
Gem stones	(3)	100	(3)	100
Gold (recoverable content of ores, etc.)—troy ounces	54,165	1,896	62,863	2,200
Gypsum—short tons	729,000	2,625	817,000	2,952
Iron ore (usable)—long tons, gross weight	845,000	4,608	617,000	3,238
Lead (recoverable content of ores, etc.)—short tons	1,791	369	771	142
Manganese ore (35 percent or more Mn) short tons, gross weight [4 5]	28,573	1,852	----	----
Mercury—76-pound flasks	7,486	1,480	6,573	1,257
Perlite—short tons	29,544	240	25,067	205
Petroleum (crude)—thousand 42-gallon barrels	154	(2)	[6] 137	(2)
Sand and gravel—short tons	7,095,000	7,443	7,850,000	9,655
Silver (recoverable content of ores, etc.)—troy ounces	388,426	359	245,164	266
Stone—short tons	677,000	1,576	722,000	1,220
Talc and soapstone—do	3,090	33	6,157	55
Tungsten ore and concentrate short tons, 60-percent WO_3 basis	(2)	(3)	156	234
Zinc (recoverable content of ores, etc.)—do	453	104	281	65
Value of items that cannot be disclosed: Clays, diatomite, lime, magnesite, molybdenum concentrates (content), pumice (volcanic cinder), salt, surfur ore, uranium ore (1961), and values indicated by footnote [2]	----	[7] 10,815	----	10,307
Total	----	[7] 81,533	----	83,733

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Weight not recorded.
[4] Includes concentrates and nodules.
[5] Quantity and value of low-grade shipments to custom mills not included.
[6] Preliminary figure.
[7] Revised figure.

TABLE 2.—Employment and injuries in the mineral industries [1]

Industry	1961 [2]					
	Employees	Man-hours (thousands)	Injuries			Injury frequency rate [4]
			Fatal	Nonfatal	Total	
Metal mines and mills [5]	2,934	6,049	4	118	122	20.17
Nonmetallic mines and mills	707	1,446	----	35	35	24.20
Stone quarries	183	287	----	5	5	17.4
Sand and gravel operations	576	916	----	14	14	15.28
Total	4,400	8,698	4	172	176	20.23
	1962 [3]					
	Employees	Man-hours (thousands)	Injuries			Injury frequency rate [4]
			Fatal	Nonfatal	Total	
Metal mines and mills [5]	2,421	5,206	4	91	95	18.25
Nonmetallic mines and mills	725	1,443	----	48	48	33.26
Stone quarries	111	194	----	----	----	----
Sand and gravel operations	552	395	----	10	10	25.32
Total	3,809	7,238	4	149	153	21.14

[1] Excludes the mineral fuels industry and officeworkers. Data collected and compiled by the Federal Bureau of Mines in cooperation with the Nevada State Inspector of Mines.
[2] Final figures.
[3] Preliminary figures.
[4] Total number of disabling injuries during the year per million man-hours.
[5] Includes metallurgical plants to avoid disclosing individual company confidential data.

Consumption, Trade, and Markets.—At least 3 mineral commodities and both metallic and nonmetallic mineral production were reported from each of the 17 counties. In 1962, 25 different commodities were produced: 1 mineral fuel (petroleum), 9 metal ores or concentrates, and 15 nonmetallic minerals. Petroleum was shipped to a California refinery. Metal ores, concentrates, and residues were consigned to mills and smelters in neighboring States in most instances. Nevada had one smelter (copper), one tungsten carbide plant (consuming Nevada and other tungsten concentrates), one titanium metal plant (processing imported titanium minerals), and one plant treating manganese ores from California and Mexico to produce electrolytic manganese dioxide. Most nonmetallic minerals were entirely or partially consumed in the State; all others were processed to some extent for out-of-State customers. Some of the 1961 fluorspar market was lost to Mexican mines, and some former captive lime production was replaced by open-market suppliers outside of Nevada.

Legislation and Government Programs.—There were no reported revisions or additions to the Nevada State mining laws by the Nevada Legislature. Public land orders restored nearly 60,000 acres of land to mineral location under U.S. mining laws, over 40,000 acres of which was restored by the Atomic Energy Commission in Nye

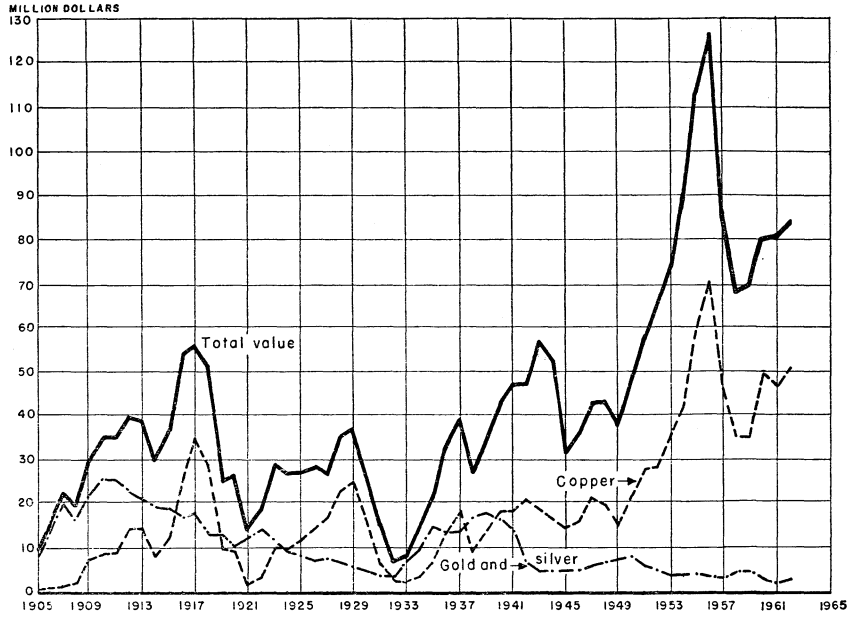

FIGURE 1.—Value of gold and silver, copper, and total value of mineral production in Nevada, 1905–62.

County. Land orders also withdrew about 628,000 acres from six counties for use by Federal agencies. Of this total, the U.S. Navy withdrew from mineral location 600,000 acres in Pershing County. During 1962 the State of Nevada received U.S. Treasury checks totaling $208,619.69 in bonuses, royalties, and rentals from mineral leasing on Federal lands within the State borders.

Two contracts for minerals exploration under the supervision of the Office of Minerals Exploration (OME) were in force during 1962. One was for gold and uranium in Nye County, executed March 1; the other was for gold and silver in Eureka County, executed September 6. The total value of the contracts was $153,500, with Government participation of $76,750. A third contract was awarded for copper and silver in White Pine County, but the applicant returned the contract for cancellation, leaving two active contracts at yearend. Nine additional applications were received in 1962—eight for gold and silver, and one for tin, copper, and silver.

Bureau of Mines facilities in Nevada comprised the Reno Metallurgy Research Center and its Boulder City Metallurgy Research Laboratory. The Reno Center also housed the Reno Office of Mining Research and the Reno Field Office, Division of Mineral Resources. Metallurgists at the Boulder City facility demonstrated the feasibility of electrorefining impure hafnium to obtain needed control-rod material for atomic reactors. The method was originally developed by the Bureau for refining titanium metal.

Bureau of Mines engineers completed investigations of the Virgin Mountains beryllium deposits, Clark County, and examined reported beryl occurrences in Elko, Mineral, Pershing, and White Pine Counties. Fluorspar deposits in Lander, Pershing, and Nye Counties were investigated as a possible source of beryllium. Bureau engineers also investigated reported tellurium occurrences at the Silver King Mines, Inc., property in the Ward Mountain area, White Pine County, and at the Plainview gold mine in the Rochester area, Pershing County.

Under terms of a cooperative agreement, in effect since 1960, the Federal Bureau of Mines and the Nevada Bureau of Mines continued a joint study and evaluation of Nevada clays and similar nonmetallic minerals for ceramic and other uses. At the Federal Bureau's Nonmetallic Laboratory, Seattle, Wash., kaolinite samples from a Pershing County property and bentonite samples from seven Nye County and two Mineral County deposits were being evaluated and tested. In addition to the tests at the Seattle facility, kaolinite from Esmeralda County and bentonite from Mineral and Nye Counties were undergoing tests in the Bureau's Petroleum Research Laboratory, San Francisco, Calif.

Participation in the Lead and Zinc Mining Stabilization Program for the calendar year 1962 did not reach expectations. The program was authorized by Public Law 87-347, enacted October 3, 1961. Funds

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were appropriated July 25, 1962, and regulations were published July 28. Between September 1 and yearend, seven Nevada producers were certified, five of which received production eligibility quotas for 1962 but only three received payment. Of the seven certified, there were two each in Elko, Lincoln, and White Pine Counties, and one in Eureka County. One each in Elko and Lincoln Counties did not receive 1962 eligibility quotas. Payments were made to Caesar Caviglio (Willard mine) and Hamilton Corp. (Onetha mine), White Pine County, and to Chas. A. Vaccaro (Mountain View mine), Eureka County. The maximum production eligible for 1962 in Nevada under the program was 242 tons of lead and 556 tons of zinc. Payments were made on 64 tons of lead and 40 tons of zinc.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—Pacific Antimony Metals Co., Reno, leased several antimony properties in Lander and Nye Counties. The company renovated the El Capitan tungsten mill at Gabbs, Nye County, to produce an antimony concentrate for export to Japan. About 10 tons of concentrate was produced, but no shipments were made.

Beryllium.—The Anaconda Company purchased the majority holdings of Mt. Wheeler Mines, Inc., White Pine County, and continued exploration of the extensive beryllium deposit. The company's lease on the adjoining Jeppson property was dropped. Mt. Wheeler ore was sent to Bureau of Mines research facilities in Salt Lake City, Utah, for testing. Beryllium Associates of Salt Lake City continued exploration of the Leavitt claims in the Virgin Mountains, Clark County.

Copper.—Recoverable copper output rose about 6 percent, attributed principally to the higher tonnage of sulfide ore mined and treated by The Anaconda Company in Lyon County. Virtually all the copper recovered from ores mined in 1962 came from the mines of The Anaconda Company and Kennecott Copper Corp., White Pine County; Copper Canyon and Copper Queen mines, Lander County; and Bristol Silver Mines, Lincoln County. Seventeen lode mines contributed to the State's copper production, but only eight were classified as copper mines. Anaconda mined both oxide and sulfide copper ores at Weed Heights and planned expansion of its sulfide treatment plant early in 1963. Kennecott limited its mining to the Liberty pit, but also processed stockpiled ore previously mined from the Veteran pit. Bristol Silver produced during only 2 months in 1962. Most of the Lander County output was recovered in the treatment of dump material at the Copper Canyon mine.

Exploration for copper ore was at a comparatively high level. Bear Creek Mining Co. explored the Ruth area, Robinson district, White Pine County, and Duval Sulphur & Potash Co., the Copper Canyon-Copper Basin area, Lander County. Homestake Mining Co. investigated the Crescent Peak area, Clark County; Newmont Exploration, Ltd., and Hidden Splendor Mining Co. completed an exploration program in the Pioche district, Lincoln County; and

American Exploration & Mining Co. investigated several old mining properties in the Cortez district, Eureka County. Silver King Mines, Inc., Bunker Hill Co., and Duval Sulphur & Potash Co. located claims in the Ward Mountain area, White Pine County, and began exploring for copper ore.

TABLE 3.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing [2]		Material sold or treated [3] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
1953–57 (average)	123	10	10,540	79,714	$2,790	810,972	$734
1958	102	14	9,792	105,087	3,678	932,728	844
1959	67	10	8,788	113,443	3,971	611,135	553
1960	72	9	12,013	58,187	2,037	707,291	640
1961	62	10	12,067	54,165	1,896	388,426	359
1962	39	4	13,121	62,863	2,200	245,164	266
1904–62 [4]	----------	----------	[5]	15,230,121	381,074	316,558,354	217,529

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	73,913	$50,263	4,613	$1,335	4,459	$1,099	$56,221
1958	66,137	34,788	4,150	971	91	19	40,300
1959	57,375	35,228	1,357	312	217	50	40,114
1960	77,485	49,745	987	231	420	108	52,761
1961	78,022	46,813	1,791	369	453	104	49,541
1962	82,602	50,883	771	142	281	65	53,556
1904–62 [4]	2,811,412	1,106,341	392,421	62,430	483,354	93,488	1,860,862

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes retreated, and ore and old tailings shipped to smelter during calendar year indicated.
[2] Excludes itinerant prospectors, "snipers," "high graders," and others who gave no evidence of legal right to property.
[3] Does not include gravel washed.
[4] The first satisfactory annual canvass of mine production was made in 1904.
[5] Data not available.

Gold.—Output of gold rose 16 percent above that of 1961. The increased recovery was credited entirely to reactivation of the Getchell mine, Humbolt County. The company began bullion shipments from its new gold ore treatment plant in July. Gold-arsenic ore was mined from a series of open pits and treated in the redesigned plant. About 36 percent of all recovered lode gold came from gold ores of 16 mines, 63 percent was recovered as a byproduct in treating copper ores, and only 1 percent came from all other lode sources. Placer gold recovery was limited to a drift mine, Nye County; a dragline operation, Pershing County; small-scale hand method production, Lander County; byproduct output at a sand and gravel washing plant, Lyon County; and retreatment of old placer tailings, Humbolt County.

Kerr-McGee Oil Industries and Newmont Exploration, Ltd., were exploring for gold in the Goldacres area, Lander County, site of a former major lode gold producer.

TABLE 4.—Mine production of gold, silver, copper, lead, and zinc in 1962, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value	Troy ounces	Value
Clark	3		23	$805	1,041	$1,129
Elko	3		16	560	2,452	2,660
Eureka	3		(2)	(2)	(2)	(2)
Humboldt	3	1	22,417	784,595	1,904	2,066
Lander	6	1	332	11,620	23,790	25,812
Nye	1	1	821	28,735	165	179
Pershing	4	1	83	2,905	267	290
Washoe	1		21	735	10	11
White Pine	7		(2)	(2)	(2)	(2)
Undistributed [3]	8		39,150	1,370,250	215,535	233,856
Total	39	4	62,863	2,200,205	245,164	266,003

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Clark	5,100	$1,571	761,900	$70,095	4,400	$506	$74,106
Elko	(2)	(2)	37,400	3,441	(2)	(2)	6,661
Eureka	2,300	708	179,900	16,551	252,800	29,072	46,331
Humboldt							786,661
Lander	(2)	(2)	146,800	13,505	67,300	7,740	58,677
Nye					200	23	28,937
Pershing			100	9	100	11	3,215
Washoe							746
White Pine	(2)	(2)	(2)	(2)	216,600	24,909	24,909
Undistributed [3]	165,196,600	50,880,553	415,900	38,263	20,600	2,369	52,525,291
Total	165,204,000	50,882,832	1,542,000	141,864	562,000	64,630	53,555,534

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal rights to property.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Includes Douglas, Esmeralda, Lincoln, Lyon, Mineral, Storey Counties, and counties indicated by footnote 2.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Gold	16	123,604	22,312	1,928		100	200
Silver	6	1,393	41	31,345	13,800	96,700	110,600
Copper	8	12,991,011	38,748	177,264	165,173,100	16,100	16,800
Lead	6	1,308	319	12,413	10,200	442,000	71,700
Lead-zinc	1	41		357	1,400	4,400	4,800
Zinc	2	581	1	198		87,800	289,100
Total	39	13,117,938	61,421	223,505	165,198,500	647,100	493,200
Other lode material:							
Lead residue	(2)			616	5,000	748,500	1,600
Old tailings	(2)	3,513	193	20,880	500	146,400	67,200
Total	(2)	3,513	193	21,496	5,500	894,900	68,800
Total lode material	39	13,121,451	61,614	245,001	165,204,000	1,542,000	562,000
Placer	4	(3)	1,249	163			
Total all sources	43		62,863	245,164	165,204,000	1,542,000	562,000

[1] Details will not necessarily add to totals shown, because some mines produce more than one class of material.
[2] From property not classed as a mine.
[3] 11,100 cubic yards.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, in 1962, by types of material processed, and methods of recovery, in terms of recoverable metals

Type of material processed, and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation and cyanidation: Ore	22,183	2,105	----	----	----
Concentration and smelting of concentrates: Ore	37,922	168,400	163,661,600	13,700	2,800
Direct smelting: Ore	1,509	73,880	1,537,400	779,800	557,600
Lead residue	----	616	5,000	748,500	1,600
Total	1,509	74,496	1,542,400	1,528,300	559,200
Placer	1,249	163	----	----	----
Grand total	62,863	245,164	165,204,000	1,542,000	562,000

Iron Ore.—A 27-percent drop in shipments of usable iron ore was attributed largely to production losses occurring at Pershing County mines in the changeover to new lessees on Southern Pacific Co. land, and to the fact that a few smaller former producers either were idle or closed down during the year. Except for three instances, two of which involved relatively minor tonnages, all shipments were exported to Japan via the port of Stockton, Calif.

Exploration for iron ore was conducted at two locations in Lyon County, in the Dayton area by Utah Construction & Mining Co., and in the Pumpkin Hollow area by Columbia Iron Mining Co.

The Iron King mine, Humboldt County, was the only underground iron mine in the State, and Standard Slag Co., Douglas County, operated the only iron ore concentrator, although Nevada Iron Ore Co., Pershing County, completed a magnetic separation plant on its Section 32 property before yearend.

Iron and Steel Scrap.—Consumption of ferrous scrap declined. The tonnage of shredded detinned steel consumed at The Anaconda Company copper-leaching plant, Lyon County, was about 9 percent lower than in 1961, and iron and steel scrap charged to electric furnaces in Nevada foundries was about 5 percent less. There was little change in the quantity of home scrap produced, and no reports of purchased scrap were received from dealers and other sources.

Lead.—Nearly half (49 percent) of the recoverable lead output was contained in lead residue shipped from the cleanup operations of a former manganese producer in Clark County. Nearly 29 percent of the total lead came from ores of six operating lead mines, 9.5 percent was recovered from old tailings of an inactive lead mine, and about 13 percent was from all other primary sources. Two fewer mining operations yielded 57 percent less lead than in 1961.

Umont Mining, Inc., of Salt Lake City, Utah, explored properties in the Hamilton district, White Pine County, in search of lead ore. In Eureka County, Consolidated Eureka Mining Co. explored for lead at its diamond mine under an OME contract.

Mercury.—Production of mercury declined for the second year, dropping 12 percent below that of 1961. Shipments were down nearly 16 percent, and yearend stocks were down 45 percent. Fourteen

mercury properties were active all or part of the year, seven less than in 1961. Only one, the Cordero mine in Humbolt County, yielded more than 100 flasks of the metal. The reduced activity was best indicated by the tonnage of mercury ores mined, 23,500 tons less in 1962 than in 1961, a 31-percent drop.

TABLE 7.—Mercury production, by methods of recovery

Year	Direct-furnaced		Retorted		Unclassified[1] flasks	Total		Operating mines
	Ore (short tons)	Flasks	Ore (short tons)	Flasks		Flasks	Value[2]	
1953–57 (average)	32,913	4,762	4,026	465	3	5,230	$1,338,953	32
1958	130,328	19,533	24,668	2,739	41	7,336	1,680,384	35
1959						7,156	1,627,847	20
1960						7,821	1,648,354	20
1961	103,088	13,705	26,013	353	1	7,486	1,479,308	21
1962						6,573	1,256,823	14

[1] Includes mercury recovered from miscellaneous dump material.
[2] Value calculated at average New York price.

Molybdenum.—Molybdenite concentrate was recovered as a byproduct at the McGill copper concentrator of Kennecott Copper Corp., White Pine County. The tonnage recovered in treating copper ore from the nearby Robinson district was only slightly above that of 1961, but shipments rose 13 percent. A 5-year exploratory drilling program was continued on a reduced scale for The Anaconda Company at the Hall molybdenum property in the Manhattan district, Nye County.

Silver.—Production of recoverable silver dropped 37 percent from 1961, chiefly because of the inactivity at silver mines in Esmeralda County. Only 6 silver mines were active, compared with 16 in 1961. Silver output was limited primarily to byproduct recovery at a White Pine County copper concentrator, which was also less than in 1961. Ores from White Pine County mines yielded 72 percent of all the recoverable lode silver.

Extensive exploration was underway for silver ore in the Lynn Creek area, Elko County, by Newmont Exploration, Ltd., and in the Ward Mountain area, White Pine County, by Silver King Mines, Inc. The latter company acquired a lease from the city of Ely, Nev., on a mill site at Lackawanna Springs, northeast of Ely, and scheduled construction of a 200-ton-a-day mill for 1963. The Danite Mining & Exploration Co. explored the Mammoth mine near Gardnerville, Douglas County, and Callahan Mining Corp. contracted the drilling of a deposit in the Silver Peak district, Esmeralda County. Tonopah Chemical & Silver Co., also in Esmeralda County, prepared for operations involving the retreatment of old tailings at Millers.

Tungsten.—Four mines were active part of 1962, each one in Churchill and Pershing Counties and two in Nye County. In every instance, the ores were upgraded before shipment to buyers or consumers. Total sales, including stockpiled concentrates from previous operations, were only one-third those in 1961. Nevada Scheelite Division, Kennametal, Inc., operated its tungsten carbide plant,

near Rawhide, using tungsten concentrates purchased from Nevada, California, and Arizona shippers. Nevada-Massachusetts Co. sold at auction all buildings and equipment, including that underground, at its Tungsten, Pershing County, operations in September. Only the land was retained by the owner. The mine and plant had been closed down in 1958.

Zinc.—The drop of 38 percent in recoverable zinc output was attributed principally to lower ore production and shipments at two mines—the Argenta Consolidated, Clark County, and the Bristol Silver, Lincoln County. A much lower tonnage of lead residue (containing recoverable zinc) was shipped from cleanup operations at a previously operating Clark County manganese plant. The major sources of recoverable zinc were Mountain View mine (zinc ore), Eureka County; Galena mine (old lead tailings), Lander County; and Hamilton mine (lead ore), Willard mine (zinc ore), and Ward Group (silver ore), White Pine County. In contrast with 1961, about 51 percent of the zinc output was recovered from zinc ores; 20 percent from silver ores; 25 percent from lead ores, residues, and tailings; 3 percent from copper ores; and the remaining 1 percent from lead-zinc and gold ores.

Other Metals.—No manganese or uranium ores or concentrates were produced or shipped in Nevada during 1962. However, at Henderson, Clark County, American Potash & Chemical Corp. produced electrolytic (battery-active) manganese dioxide from California and Mexico ores. Also at Henderson, Titanium Metals Corporation of America used rutile imported from Australia to produce titanium metal.

Activity was limited to assessment work at cobalt-nickel prospects, Landers County, and columbium-tantalum claims, Humboldt County. No activity of any kind was reported from tin claims, Pershing County, and a titanium mineral prospect, Nye County. Exploration and development work at the Myrtle rutile property, Washoe County, was suspended in 1962. Siskon Corp., Reno, continued exploration at its (Gibellini) vanadium property, Fish Creek district, Eureka County, near the Nye County line.

NONMETALS

Barite.—The tonnage of primary barite sold and used was only slightly above that of 1961; however, production rose over 80 percent and stocks at mines were up 14,000 tons at yearend. Shipments were made to plants in California, Louisiana, and Texas. Nearly 95 percent of the total output came from Elko and Lander Counties. The major producers were Baroid Division, National Lead Co. (Rossi mine), Elko County, and Magnet Cove Barium Corp. (Greystone group) and Inorganic Chemicals Division, FMC Corp. (Mountain Springs mine), Lander County. There were three new producers of crude barite in 1962, one each in Elko, Lander, and Ormsby Counties.

The Magnet Cove mill at Battle Mountain was the only grinding plant in Nevada, but National Lead Co. started construction of a plant at Dunphy, Eureka County, to process ores from the Rossi

mine. Millwhite Mud Sales Co. conducted exploration for barite east of Battle Mountain, Lander County, as did H. A. Horton, northeast of Golconda, Humboldt County.

Brucite and Magnesite.—Before midyear Standard Slag Co. sold its processing facilities and leased its mining claims near Gabbs, Nye County, to Basic, Inc., the sole producer of magnesite in 1962. No brucite was mined during the year, but shipments of previously beneficiated and stockpiled brucite were made. Basic consumed run-of-mine magnesite, magnesite flotation concentrate, and brucite—upgraded by dense medium concentration—in making caustic-calcined and refractory magnesias and various refractory products. Although mine production of crude magnesite was slightly below 1961, the tonnages sold and consumed in making magnesia products were appreciably higher.

Clays.—Production of clay, with one exception, was from captive operations. There were two new producing bentonite properties, one each in Mineral and Nye Counties. As a result, the output of bentonite was nearly three times that in 1961. The quantities of fire clay and refractory clay produced in Washoe and White Pine Counties were 94 percent greater. Declines were reported for fuller's earth and miscellaneous clay, which were down 22 and 13 percent, respectively.

Standard Slag Co. established a testing laboratory in Sparks, Washoe County, and explored the Stoker kaolin deposit east of Lovelock, Pershing County.

Diatomite.—Sales of crude and prepared diatomite rose 13 percent. The largest increase was credited to material prepared for filtration purposes. The crude diatomite was mined at six open-pit operations, one each in Churchill, Esmeralda, Lincoln, Mineral, Pershing, and Storey Counties. Only one producer did not process diatomite in a company plant at or near the deposit. Crude material from the Churchill County pit was processed in the producer's Lyon County mill. Filler uses represented 29 percent of the total sales, and filtration, 26 percent. Major consumers were insulation, paint, paper, insecticide, abrasive, and chemical manufacturers. Shipments were about equally divided between domestic and foreign customers.

Fluorspar.—Production and shipments of crude fluorspar decreased 25 and 40 percent, respectively. The production decline was attributed to competition from Mexican producers of metallurgical-grade fluorspar. The Carp mine, Lincoln County, was inactive, but shipments were made from stocks to west coast steel mills. Shipments from the Crowell mine, Nye County, were also consigned to nine western steel plants, but mine-run fluorspar from the nearby Goldspar property was consumed in the producer's California cement plant.

Gem Stones.—In 10 counties, gem materials and mineral specimens were collected by commercial and amateur collectors, mineralogical societies and clubs, and gem dealers. Principal gem materials collected, in order of decreasing quantity, were fluorspar, agate, petrified wood, rhyolite, turquoise, quartz crystal, and opal. All the fluorspar was collected approximately 40 miles north of Austin, Lander

County. Agate was found near Gerlach, Washoe County, near Lovelock, Pershing County, and in northern Elko County. Areas near Dayton and Silver City, Lyon County, Fallon, Churchill County, and Tonopah, Nye County, yielded significant quantities of petrified wood. Rhyolite was gathered near Fallon, Churchill County, and the Pyramid Lake area, Washoe County. Turquoise was collected near Austin, Lander County; quartz crystals, in Elko and Mineral Counties; and opal, in Humboldt, Lyon, and Pershing Counties. Other gem materials and specimens found included azurite, obsidian, wonderstone, selenite, and jasper.

Gypsum.—Three gypsum deposits, two in Clark County and one in Pershing County, yielded the entire Nevada output of gypsum. The 817,000-ton production was 11 percent above that of 1961, largely attributed to the demand for building materials in the Western States, particularly California. Substantial quantities of gypsum were calcined in plants at Blue Diamond, Clark County, and Empire, Washoe County. Gypsum mined near Apex, Clark County, was shipped to the producer's plants in Newark and Los Angeles, Calif., and to portland cement plants. Sales of gypsum as a cement retarder and for agriculture were also higher in 1962.

The Leavitt Bros. explored an extensive gypsum deposit west of Mesquite, Clark County.

Lime.—In December 1961, when Kennecott Copper Corp. ceased lime production at its McGill operations, White Pine County, U.S. Lime Products Division, The Flintkote Co., became the sole producer of lime. The company operated all three of its Clark County plants in 1962. Quicklime was made at Apex, hydrated lime at Sloan, and both types were produced at Henderson. Lime sales were principally to California and other out-of-State customers. Shipments of both quicklime and hydrated lime were appreciably greater than in 1961, particularly for building.

Perlite.—Production of crude perlite rose for the first time in several years, but sales continued the decline begun in 1959. Mining was confined to two deposits in Lincoln County, the Hollinger pit near Pioche and the Mackie deposit southwest of Caliente. The crude mineral was expanded in Clark and Washoe County plants for lightweight aggregate used in plaster, concrete, and the manufacture of plasterboard. The American Colloid Co., Chicago, Ill., acquired claims and explored a perlite deposit in northern Eureka County.

Pumice (Volcanic Cinder).—Volcanic cinder was hauled for use as lightweight aggregate from three deposits, one each in Nye, Ormsby, and Storey Counties. The Storey County operation was new in 1962. Naturalite Co. developed a deposit of pearl gray volcanic ash in Storey County, a few miles northeast of Dayton, Nev. Most of the production was marketed for lightweight aggregate, and a comparatively small tonnage was sold in block form for decorative building stone.

Salt.—Fallon Development Co., subsidiary of Leslie Salt Co., contracted with E. J. Huckaby of Fallon for production of solar salt that was surfaced-mined from a dry lake bed in Churchill County. The crude salt was sold to local consumers. Somewhat less exploration

activity was conducted at saline deposits in Esmeralda County and at other locations in Nevada than in 1961.

Sand and Gravel.—The 11-percent increase in sand and gravel output over 1961 was caused by record expenditures for the interstate highway construction program in Nevada and to greatly accelerated building construction, particularly in Clark County. The unit value of this production was also higher, as larger tonnages of high quality sand and gravel were produced for concrete structures. The increase in structural concrete projects was emphasized by the fact that California cement plants shipped nearly 1.6 million barrels of portland cement into Nevada in 1962. In 1961 the figure was less than 1 million barrels.

Aggregate requirements for freeway projects shifted from low-value base materials in 1961 to higher priced bituminous and concrete aggregate prepared for surface course in 1962. Nevada State Highway Department needs for construction and maintenance rose from 4.4 million tons of pit-run and prepared material in 1961 to 4.8 million tons of predominantly prepared sand and gravel.

Nearly 6.2 million tons of the total output were produced by commercial operators, Government crews, and contractors, using portable equipment. Only 1.7 million tons were produced at stationary plants. There were 97 active sand and gravel operations in the State, 39 of which were commercial plants. Each of six commercial operations yielded 100,000 tons or more. Two commercial operations were in the 500,000-ton-or-over class.

Output of industrial silica sand in the Overton area, Clark County, and in the Panaca area, Lincoln County, were 11 percent above those of 1961.

Stone.—The increase in stone production in 1962 was due largely to a greater demand for rubble, used principally in a Clark County levee project, and crushed aggregate used in construction of county roads in Churchill County. The major tonnages were in low-value stone, accounting for the overall decline in average unit value from $2.33 per ton in 1961 to $1.69.

The abundance of sand and gravel deposits in areas of roadbuilding activity precluded the use of very large quantities of stone in building State highways. The 1962 requirements, primarily for Interstate Highways 15 and 80, totaled less than 2,500 cubic yards, all for riprap.

Limestone quarried in Clark County represented a substantial part of the total stone production in Nevada. Calcareous marl was quarried in Nye and Washoe Counties and prepared for agricultural and filler uses. Quarries in Clark, Elko, Humboldt, and White Pine Counties supplied dimension and crushed sandstone, quartz, or quartzite used as flagging, building stone, and roofing granules. A larger tonnage of marble for terrazzo was quarried in Mineral County, and aragonite was produced for ornamental use from the Connoly deposit in Nye County. Miscellaneous (unclassified) stone was quarried in nearly all 17 counties of the State, mainly for riprap and railroad ballast.

TABLE 8.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1961		1962	
	Short tons	Value	Short tons	Value
Commercial operations:				
Sand:				
Glass	(1)	(1)	(1)	(1)
Molding	(1)	(1)	(1)	(1)
Building	364,267	$611,489	690,095	$1,317,312
Paving	151,404	169,832	(1)	(1)
Fill	20,661	20,494	25,217	23,342
Other	49,547	114,153	54,591	145,828
Gravel:				
Building	472,797	785,552	881,113	1,416,466
Paving	1,180,536	838,198	767,882	837,448
Railroad Ballast	(1)	(1)	(1)	(1)
Fill	255,933	258,894	450,032	461,390
Other	(1)	(1)	998	1,942
Undistributed sand and gravel	140,279	557,046	178,304	653,078
Total sand and gravel	2,635,424	3,355,658	3,048,232	4,856,806
Government-and-contractor operations: [2]				
Sand:				
Building	1,257	4,525	8	27
Paving	76,839	69,542	101,219	125,396
Fill	8,550	14,250	13,048	50,581
Total	86,646	88,317	114,275	176,004
Gravel:				
Building	1,809	6,512	1,239	1,255
Paving	4,350,947	3,971,010	4,605,892	4,555,098
Fill	114	57	55,628	40,400
Other	20,070	21,642	25,000	25,000
Total	4,372,940	3,999,221	4,687,759	4,621,753
Total sand and gravel	4,459,586	4,087,538	4,802,034	4,797,757
All operations:				
Sand	803,827	1,549,696	1,033,526	2,280,672
Gravel	6,291,183	5,893,500	6,816,740	7,373,891
Grand total	7,095,010	7,443,196	7,850,266	9,654,563

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes figures for State, counties, municipalities, and other Government agencies.

TABLE 9.—Stone sold or used by producers, by uses [1]

Use	1961		1962	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rubble—short tons	(2)	(2)	45,430	$80,256
Rough architectural—cubic feet	[3] 12,307	$66,600	[5] 14,012	[6] 83,745
Approximate equivalent—short tons	[4] 2,946	----------	[6] 2,557	----------
Sawed stone and cut block—cubic feet	(2)	(2)	(2)	(2)
Total [7]—approximate short tons	2,946	66,600	47,987	164,001
Crushed and broken stone—short tons	674,419	1,509,494	673,785	1,055,499
Grand total—approximate short tons	677,365	1,576,094	721,772	1,219,500

[1] Includes basalt, granite, marble, calcareous marl, sandstone, and miscellaneous stone.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes sawed stone and cut block.
[4] Includes rubble, rough construction stone, sawed stone, and cut block.
[5] Includes sawed stone and cut block and flagging.
[6] Includes rough construction stone, sawed stone, and cut block and flagging.
[7] Total for 1962 includes rubble, rough construction dimension stone, and flagging.

Sulfur.—Production of sulfur from Nevada's only active mine, near Sulphur, Humboldt County, was virtually unchanged from 1961. The producer shipped the entire output for use as a soil aid, and yearend stocks were unchanged. The Anaconda Company obtained sulfur ore for its Weed Heights, Lyon County, acid plant from its mine in California.

Talc and Soapstone.—Production and shipments of talc and soapstone rose 100 and 84 percent, respectively, above 1961. This was the first reported increase since 1959 and the highest tonnages since 1957. The entire output came from Esmeralda County deposits, and was consigned to California grinding plants or sold to out-of-State consumers.

Water.—Magma Power Co. drilled test wells at Darrough Hot Springs in Smokey Valley, Nye County, to determine the geothermal potential of the area, but the results of the drilling were not disclosed. The company has been active in an attempt to develop the Small Geysers area near Beowawe, Eureka County, to the point of negotiating the erection of a steam power plant at the well sites. Western Geothermal, Inc., an affiliate of Natomas Co., acquired a lease on lands in the Pyramid Lake Indian Reservation, Washoe County. The company drilled an exploratory well near Needle Rocks at the north end of Pyramid Lake. Steam and hot water were encountered in the 4,000-foot hole, and at yearend tests were underway to evaluate the sustained volumes of geothermal energy available.

MINERAL FUELS

Natural Gas.—A 16-inch, 250-mile natural gas transmission line was under construction from the Nevada-Idaho border to Reno at yearend. This was to be the first line to deliver natural gas to northern Nevada and would be owned and operated by Nevada Northern Gas Co. The line would connect with one being built by El Paso Natural Gas Co., supplying gas from the latter's facilities at Mountain Home, Idaho.

Petroleum.—The Eagle Springs field, Nye County, was the only producing oilfield in Nevada. There were four potentially productive wells, but only two actually produced. In late 1962, Shell Oil Co. contracted with Refiners Sales Co., Long Beach, Calif., for delivery of crude oil to a refinery the latter planned to construct at the field.

The Nevada Oil and Gas Commission issued three drilling permits in 1962, the smallest number in any year since the commission was created in 1953. One permit was for a well near Fallon, Churchill County, and two were for wells in Pine Valley, Eureka County. No permits were issued to major oil companies, and no commercial discoveries of either oil or gas were made during the year.

REVIEW BY COUNTIES

Churchill.—Production of sand and gravel decreased substantially from 1961. Materials produced the previous year were used in completing a section of Interstate Route 80 near the Pershing County line. Commercial producers of sand and gravel at Fallon supplied

local and Government requirements, including concrete and paving aggregate for projects at the Naval Air Station. Crews and contractors for the Bureau of Indian Affairs and for State and county road agencies produced sand and gravel for their own use in maintaining roads and in minor construction projects. County crews also worked several basalt and granite quarries for road base and aggregate used in surfacing county roads.

Tungsten ore was mined at the Fisk claims, in the Stillwater Range. After processing, the concentrates were shipped to the tungsten carbide plant of Nevada Scheelite, Mineral County. The company refined the carbide in a recently completed plant at Fallon before shipment to out-of-State customers. The Red Ant and Hilltop groups of tungsten claims, in the Sand Springs and Alpine districts, respectively, were idle throughout 1962.

E. J. Huckaby surface mined solar evaporated salt from a dry lake bed near Sand Springs under a contract with Fallon Development Co. The crude mineral was sold to local consumers. Crude diatomite was mined from a deposit near the county road between Brady's Hot Springs and Nightingale. The material was hauled to the producers' Fernley mill, Lyon County, for processing.

TABLE 10.—Value of mineral production in Nevada, by counties

County	1961	1962	Minerals produced in 1962 in order of value
Churchill	$1,476,205	$258,197	Sand and gravel, stone, tungsten, salt, gem stones.
Clark	[1] 11,469,672	11,834,112	Sand and gravel, lime, gypsum, stone, lead, copper, silver, gold, zinc.
Douglas	1,483,315	865,185	Iron ore, sand and gravel, gold.
Elko	753,034	1,706,713	Sand and gravel, barite, stone, lead, silver, gem stones, gold, mercury, zinc, copper.
Esmeralda	662,113	657,669	Diatomite, talc and soapstone, sand and gravel, mercury, silver, gold, lead, zinc, gem stones.
Eureka	1,199,186	705,242	Iron ore, stone, zinc, lead, gold, silver, copper.
Humboldt	3,554,729	2,827,369	Mercury, gold, iron ore, barite, stone, tungsten, sulfur ore, sand and gravel, gem stones, silver.
Lander	1,048,159	1,147,444	Barite, ore ore, sand and gravel, copper, silver, lead, gold, zinc, gem stones.
Lincoln	725,786	418,230	Sand and gravel, perlite, fluorspar, copper, silver, diatomite, zinc, lead, stone, gold.
Lyon	18,956,841	26,036,192	Copper, diatomite, sand and gravel, silver, gold, clays, gem stones.
Mineral	236,835	217,868	Sand and gravel, barite, stone, gold, lead, diatomite, iron ore, silver, clays, gem stones, mercury, zinc.
Nye	[1] 3,175,872	2,578,354	Magnesite, sand and gravel, petroleum, fluorspar, gold, iron ore, pumice (volcanic cinder), mercury, tungsten, clays, stone, gem stones, silver, zinc.
Ormsby	60,883	70,028	Sand and gravel, pumice (volcanic cinder), mercury, barite.
Pershing	3,561,270	3,781,007	Diatomite, gypsum, iron ore, sand and gravel, tungsten, perlite, mercury, gold, silver, stone, gem stones, zinc, lead.
Storey	[2]	1,382,614	Diatomite, iron ore, pumice, gold, silver.
Washoe	1,120,215	1,442,912	Sand and gravel, clays, stone, gold, gem stones, silver.
White Pine	[1] 30,756,656	27,713,378	Copper, gold, molybdenum, sand and gravel, silver, lead, zinc, tungsten, stone, clays.
Undistributed [3]	[1] 1,292,229	90,486	
Total	[1] 81,533,000	83,733,000	

[1] Revised figure.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Includes gem stones, silver, mercury, and gold that cannot be assigned to specific counties and value indicated by footnote 2.

Clark.—Sand and gravel production was double the 1961 output, with 59 percent of the total produced at commercial plants in the Las Vegas area. Substantial quantities of these materials were used in street and building construction in Las Vegas and North Las Vegas, and in road construction near Henderson and on Insterstate Route 15 near Glendale. WMK Transit Mix, Inc., added a 12-cubic-yard transit cement mixer to its Las Vegas operation. Silica sand output in the Overton area was up 11 percent. The material was sold for molding, glass, furnace, and blast sand, and for other industrial uses. Sandstone and limestone were quarried, crushed, and screened at the Simon Rainbow Quarries, southwest of Jean. The materials were sold for flagging and landscaping, and as roofing granules. The W. C. Scott Valley of Fire quartz quarries were worked to produce decorative building stone. A Bureau of Reclamation contractor quarried granite for use in levee construction and maintenance projects. Small tonnages of limestone and miscellaneous stone were quarried from deposits on Federal lands and processed for building and paving uses. Railroad ballast and aggregate material required by Nellis Air Force Base were supplied by Las Vegas producers.

U.S. Lime Products Division, The Flintkote Co., quarried high-calcium limestone at Apex and dolomitic limestone at Sloan. The raw materials were used in making lime in plants at Apex, Sloan, and Henderson, or sold to metallurgical plants and sugar refineries. The company, largest lime producer in the West, produced quicklime at Apex, hydrated lime at Sloan, and both types at Henderson. The plant products were sold to the construction, chemical, and other industries, principally at out-of-State locations. Blue Diamond Co. mined gypsum from its deposit near Blue Diamond and processed the mineral for the manufacture of plaster and wallboard, and for use in cement and for agriculture. Fibreboard Paper Products Corp. strip mined gypsum near Apex for shipment to its board plants at Newark and Los Angeles, Calif. During the year a gypsum prospect near Riverside was explored as a possible source of agricultural gypsum. Crude perlite purchased from a Lincoln County producer was expanded in a Las Vegas plant by Nevada Perlite Co. for lightweight aggregate used in plaster and concrete. Lovelite Cosmetics, Inc., processed bentonite, from its Nye County deposit, in its Las Vegas plant. The mineral was used in making a variety of cosmetics and other products.

Cleanup operations on the former site of the Manganese, Inc., mill and plant yielded lead residue containing nearly half of the recoverable lead produced in the State during 1962. The residue also contained recoverable silver, copper, and zinc. Lead, silver, copper, and zinc were also recovered from lead ore mined from the Argenta Consolidated property, Yellow Pine district. Gold ores from the Blossom mine, Searchlight district, and the Susan mine, Gold Butte district, yielded gold and silver. Copper was recovered from silver ore. American Potash & Chemical Corp. produced electrolytic manganese dioxide from domestic and foreign manganese ores in its Henderson plant. Also at Henderson, Stauffer Chemical Co. produced chlorine and caustic soda from salt purchased outside the

State, and Titanium Metals Corporation of America produced titanium metal and alloys from rutile imported from Australia.

Douglas.—Standard Slag Co. operated the Minnesota iron mine and began shipments of iron ore concentrates from its new treatment plant in May. Plant processing included crushing, magnetic separation, and sintering. Although most of the shipments were a sintered product, the company also shipped direct-shipping-grade ore. All shipments were consigned for export. The Danite silver property in the Gardnerville district was idle, but exploration and development work was reported at the Copper Chief prospect and Monarch mine in the same area. In the Mountain House district exploration only was reported for the Arrowhead and Willard-McDonald mines, and gold ore at the Westmont No. 1 claim was treated by amalgamation to recover a small quantity of the metal.

Sand and gravel was produced in the Minden-Gardnerville area by John L. Savage Construction Co. and Nevada Contractors, Inc. The output was used as concrete aggregate. Savage's material was hauled to the company's batch plant at Carson City, Ormsby County, and to building projects at the Stateline area on Lake Tahoe. Crews and contractors for the Bureau of Indian Affairs and the Nevada State Highway Department obtained sand and gravel from various locations for use in road maintenance.

Elko.—Nearly 1.3 million tons of sand and gravel were produced in the county. A substantial part of the output was used in the construction of Interstate Highway 80 between Elko and Halleck, U.S. Highway 93 between Contact and the Idaho border, and a 12-mile section of State Route 30 south of Montello. A small tonnage of miscellaneous stone was quarried for use as riprap in those road projects. Sand and gravel was produced by crews and contractors of local, county, State, and Federal agencies for maintenance of roads and highway structures. At Elko, Bernadot's Red-E-Mix Concrete and White & Alter produced concrete aggregate chiefly for building construction. Utah Calcium Co. of Salt Lake City, Utah, prepared quartz from its Goliath quarry near Jiggs and shipped the material out of State for use as exposed aggregate.

National Lead Co. Baroid Division mined and shipped crude barite from its Rossi mine to company processing facilities at Merced, Calif. Estabrook Barite Co. shipped barite from its Marvel mine, north of Carlin, to a California grinder. A new barite deposit was worked near Wilkins, and the crude mineral was shipped to a grinder in the San Francisco Bay area.

Three lode mines were active all or part of 1962. Lead ores, containing recoverable silver and zinc, from the Delno and Gold Note mines, Delano district, were shipped to a California smelter. Gold ore produced from the Zero mine, Tuscarora district, was treated by amalgamation to recover gold and silver. The Governor group of claims, Ivanhoe district, yielded a small tonnage of cinnabar ore that was retorted to recover the mercury.

Esmeralda.—Great Lakes Carbon Corp., Dicalite Division, mined and processed diatomite near Basalt. Most of the plant products were shipped out of State for filler uses. The entire Nevada talc and soapstone production was obtained from six deposits in the county.

The output was nearly double that in 1961, but the unit value was lower. Production of gravel was limited to the tonnage required as base material and surface aggregate prepared by Stout Construction Co. in the construction of an access road off U.S. Highway 6 near the Nye County line. A small quantity of pit-run sand and gravel was produced by State highway crews for road maintenance. The Snowhite opalite deposit and grinding plant of Western Silica Co., near Goldfield, was idle throughout 1962.

The Poor Boy (Red Rock) open-pit mercury mine yielded ore that was furnaced to recover the metal. Mercury produced in 1961 at the B&B mine was shipped during 1962. Both properties are in the Fish Lake Valley district. A few tons of silver ore, that contained recoverable silver, lead, and zinc, was produced from the Queen mine, at the head of Queen Canyon near Mustang Mountain. Clean-up operations at Millers Flat, preparatory to the re-treatment of old tailings, yielded several hundred ounces of silver and a small quantity of gold.

Eureka.—Nevada-Barth Mining Corp. operated the Barth iron mine near Carlin throughout 1962. Reported production and shipments were below those of 1961, yet the company was the major Nevada producer of direct-shipping ore. The entire output was consigned for export. Lead ore from the Consolidated Eureka mine, Eureka district, and zinc ore from the Mountain View mine, Lone Mountain district, yielded most of the recoverable gold, silver, lead, and zinc and some of the recoverable copper produced in the county. Dump material at the Keystone mine, Roberts district, was shipped to a California smelter primarily to recover silver and lead. The material also contained recoverable copper and zinc.

Miscellaneous stone was quarried and prepared near Palisades for use as railroad ballast by the Southern Pacific Co.

Humboldt.—Over 95 percent of the mercury produced and shipped in Nevada during 1962 was recovered from ore mined and furnaced at the Cordero mine, McDermitt district. Mercury retorted and shipped from stockpiled ore at the Hapgood mine, Poverty Peak district, constituted all of the other 1962 activity at mercury properties in the county. Getchell Mine, Inc., consigned the last of its stockpiled tungsten concentrates recovered from ores in previous years to a San Francisco, Calif., buyer. The company also started bullion shipments from its new gold ore treatment plant at the Getchell mine. A small quantity of high-grade material containing recoverable gold and silver was shipped to a California smelter from the inactive National mine, National district, by Whelchel Mines Co. Some old placer tailings in the Belmont Hill area were reworked to recover gold and silver. The Iron King underground iron mine, Jackson Mountain area, was active throughout the year, but production and shipments were below 1961. Direct-shipping ore was mined, 73 percent of the output was sold to domestic iron and steel plants, and the remainder was exported to Japan.

H. A. Horton worked the Little Britches barite deposit and nearby Horton claims and shipped the crude mineral to a grinder near Sacramento, Calif. County and State highway crews collectively produced about 13,000 tons of sand and gravel from various pits and

used the material in the maintenance of roads. County employees also quarried a substantial tonnage of miscellaneous stone used in protecting embankments. Wegman Bros. quarried sandstone from the Wadsworth No. 2 claim near Virgin Valley, which was sawed for architectural use. More than 600 tons of sulfur ore was mined and shipped from the Crofoot property, near Sulphur, for agricultural use.

Lander.—A grinding plant was operated at Battle Mountain by Magnet Cove Barium Corp. on crude barite from the producer's Greystone property and adjacent claims. The plant product was shipped to company facilities in Texas. Inorganic Chemicals Division, FMC Corp., mined crude barite from its Mountain Springs mine and shipped it to the company's Modesto, Calif., chemical plant. Millwhite Mud Sales contracted the mining of barite from the Barium King mine (Glidden Lease/Argenta); the barite was shipped to company processing facilities in Louisiana. The Shelton family worked the Barite No. 3 claim and the Tony Miller property, and shipped to barite grinders in California. Metals Disintegrating Co. shipped primary barite from its Yuba No. 1 (Shelton) claim to a company plant in California, and to customers in Washington and Utah. Tom Norris opened up a barite deposit near Gold Acres and shipped to a grinder in the San Francisco Bay area.

Tom Norris also shipped some old tailings that contained appreciable quantities of lead, zinc, silver, and gold from the Galena mine, the Battle Mountain district, to a California lead smelter. In the same district, ore from the Copper Queen mine and dump material at the Copper Canyon property was leached and the recovered precipitates shipped to the copper smelter at Tacoma, Wash. Gold ores from the McCoy mine, McCoy district, and New Pass mine, New Pass district, were treated by amalgamation, and those from the Red Hills property, Hilltop district, by cyanidation to recover gold and silver. Silver ore mined from the Patriot mine, Reese River district, were shipped to the smelter at Selby, Calif. The Dahl placers near Battle Mountain were worked by small-scale manual methods to recover gold and silver.

The McCoy iron mine, McCoy district, was active throughout 1962, and production and shipments were above those of 1961. Direct-shipping ore was mined, and the entire production was shipped for export.

Holcomb Construction Co. produced and prepared 67,000 tons of gravel used in construction of State Highway 18A north of Battle Mountain. State highway crews produced about 7,500 tons of pit-run and prepared sand and gravel for use in road maintenance.

Lincoln.—J. G. Shotwell, Inc., mined a high-purity silica deposit and produced a pozzolan material in a plant near Panaca, for use in concrete. Wilkin Mining & Trucking Co. produced and prepared sand and gravel in the Pioche area for local requirements. Over 163,000 tons of sand and gravel and a relatively small tonnage of stone was quarried and used in the reconstruction of U.S. Highway 93 between Alamo and Maynard Lake. Maintenance crews for local, county, State, and Federal agencies produced sand and gravel for their own needs. Combined Metals Reduction Co. worked the Hol-

linger perlite deposit, near Pioche, and shipped most of the production to out-of-State customers. A relatively small tonnage was sold to a Las Vegas expanding plant. Delamar Perlite Co. mined perlite from the Mackie property southwest of Caliente and shipped the crude material to California customers.

The Carp fluorspar mine was idle, but metallurgical-grade material was shipped from the mine stockpile to a California steel plant. Crude diatomite was shipped from a Panaca deposit to manufacturers of stock feeds and poultry grit outside the State. The Tule Valley gypsum deposit near Carp was under exploration and development by Wells Cargo, Inc.

Copper ore from the Bristol Silver mine, Jack Rabbit district, and silver ore from the Tempiute mine, Tempiute district, was shipped to a smelter at Tooele, Utah. The ores from both properties contained recoverable silver, copper, lead, and zinc.

Lyon.—Production of oxide copper ore at the Weed Heights operations of The Anaconda Company was only slightly below that of 1961, but sulfide ore production was appreciably higher. Except for some sulfide concentrates consigned to the copper smelter at Tacoma, Wash., all mill products (precipitates and concentrates) were shipped to Anaconda copper smelting facilities in Montana. Dump material at the Protection mine, Yerington district, was treated by amalgamation to recover a small quantity of gold. Dayton Sand & Gravel Co. recovered byproduct gold and silver, in addition to aggregate, at its washing plant near Silver City.

Carson Ready-Mix Concrete Co. and John L. Savage Construction Co. also prepared sand and gravel for concrete aggregate in the Silver City-Dayton area. Savage used some of the prepared material in completing a secondary road near Yerington. State highway crews produced and prepared about 6,000 tons of sand and gravel for road maintenance. Aquafil Co., division of Kohl Enterprises, Inc., processed crude diatomite from its Churchill County deposit in its Fernley mill. The mill products were sold for insulation and filler uses. Industrial Minerals & Chemical Co. mined and shipped fuller's earth from its Juniper pit, near Weeks, to its plant in California. The mineral was used principally in preparing livestock feed pellets. A few tons were consumed in filtering and clarifying and in miscellaneous uses.

Mineral.—Silver State Construction Co. prepared 132,000 tons of sand and gravel for use as base course and surface aggregate on U.S. Highway 6 between Basalt and the California border. State highway crews produced sand and gravel at various locations for use in road maintenance. Sonora Marble Aggregate Co. quarried marble near Luning and prepared the material for terrazzo. Olsen Mud Service mined crude barite from the Columbus (Noquez) mine, near Belleville, and shipped the mineral to a grinder at Terminal Island, Calif. There was no other barite activity in the county. The King diatomite claims, Cedar Mountain district, yielded material that was processed in a Laws, Calif., plant before shipment to a Texas customer. Industrial Minerals & Chemical Co. developed the Montgomery bentonite claims, near Hawthorne, and shipped the mineral to the producer's California processing plant where it was prepared for use as a water sealant in canals and reservoirs.

Antimonial lead ore from the New Potosi mine, Candelaria district, was shipped to a California smelter, and two cars of accumulated material from the assay office and laboratory were shipped to a Utah smelter. Gold, silver, lead, and zinc were recovered in both instances. Humboldt Ore Co. shipped a small tonnage of iron ore for export from the Iron Gate (Sullivan) mine east of Luning. The open-pit mining operation was reported shut down in February. Mercury ore from the Inman mine, Pilot Mountain district, was retorted to recover a small quantity of the metal. Nevada Scheelite Division, Kennametal, Inc., operated its tungsten carbide plant near Rawhide on tungsten concentrates purchased from Nevada producers and out-of-State shippers. The plant product was refined in the company's Churchill County plant before sale.

Nye.—Two wells of the Shell Oil Co.'s Eagle Springs field yielded the entire Nevada crude oil output. No new wells were drilled in the field during 1962.

Basic, Inc., purchased the processing facilities and leased the magnesite claims of Standard Slag Co. and became the sole producer of magnesite in Nevada. The company shipped both mine-run magnesite and magnesite upgraded by flotation. The brucite sold was a product previously upgraded by dense medium concentration. Run-of-mine magnesite and the mill products were processed to produce magnesias and refractory products. Some calcined magnesite and raw brucite was sold to a California producer of epsom salt. Road construction on U.S. Highway 95 between Beatty and Goldfield and an access road near U.S. Highway 6, east of Tonopah, required nearly 380,000 tons of the sand and gravel, and stone produced during 1962. County and State road crews produced their own sand and gravel for road maintenance at various locations in the county. Reynolds Electrical & Engineering Co., Inc., produced and prepared sand and gravel near Mercury for use in structural and paving projects at the Nevada Test Site. Calcareous marl was quarried by L. R. Moretti from the Silimagi deposit near Johnnie. The material was prepared for filter uses. The Crowell mine near Beatty yielded metallurgical-grade fluorspar, which was shipped to a west coast steel plant. Mine-run fluorspar from the nearby Goldspar mine was shipped to the producer's Monolith cement plant in California.

On the Nevada Porphyry property at Round Mountain, bench gravels were worked by drift methods and gold and silver recovered by amalgamation. A small tonnage of ore from the company's lode lease was processed for gold and silver by the same method. A small quantity of old tailings at the Homestake mine in the same area was also treated by amalgamation to recover gold and silver. Cleanup operations at the Northumberland mine, Northumberland district, yielded material containing recoverable gold, silver, and zinc that was shipped to a California smelter. The ore treatment plant at the Northumberland property had been dismantled in 1961. Iron ore from Standard Slag Co.'s Iron Mountain mine was consumed in the nearby Gabbs magnesite treatment plants, in the preparation of dead-burned magnesia. The Eddy (Engle) iron mine, in the Sherman Peak area, yielded direct-shipping iron ore sold to domestic iron and steel producers. This open-pit operation was shut

down in July for an indefinite period. Only one mercury mine, the Ione Mercury in the Union district, was active in 1962. Dump material at the San Pedro and Yellow Cat mercury properties, in the same district, was retorted to recover the metal. In both instances, the dump material was upgraded by flotation before retorting. Gabbs Exploration Co. shipped mercury recovered from ore furnaced at its Horse Canyon mine in 1961. Two tungsten properties in the Gabbs area were active part of the year. The tungsten concentrates produced were shipped to the Mineral County tungsten carbide plant. The Jewel tungsten mine and mill in the same area were idle.

Volcanic cinder was hauled from a cinder cone deposit near Beatty to a Las Vegas building block plant for use as lightweight aggregate. Nevada State Highway Department crews used a small tonnage of the cinder in the maintenance of State roads. Bentonite was dug near Beatty by L. R. Moretti (New Discovery claims) and Lovelite Cosmetics, Inc. (Lovelite claims), a new producer in 1962. The clay from both operations was processed for use in cosmetics and pharmaceuticals.

Ormsby.—Nearly 50,000 tons of both pit-run and processed sand and gravel was produced by Nevada State Highway crews for construction and maintenance of roads in Ormsby County. John L. Savage Construction Co. worked a sand and gravel deposit on the Carson River, near New Empire, for concrete aggregate used in its main batch facility at Carson City. Reno Ready-Mix Concrete Co. used volcanic cinder from the Cinderlite deposit, near the Carson City airport, for lightweight aggregate in building block. David Strong worked a barite deposit east of Carson City, in the Brunswick Canyon area, and shipped a small tonnage to a grinder in the San Francisco Bay area.

The iron deposit previously worked in the Brunswick Canyon area of the Delaware district was not reactivated in 1962.

Pershing.—Eagle-Picher Co. mined diatomite at its Tunnel Hill property, Velvet district, and processed the material in its Colado plant. The plant products were shipped to various domestic and foreign consumers. United States Gypsum Co. mined crude gypsum at its Empire quarry and moved the mineral by aerial tram to its mill and board plant near Gerlach, Washoe County. Stockpiled perlite, previously mined from the Pearl Hill quarry near Lovelock, was also hauled to the Washoe County plant. On-site contractors for the State highway department obtained the sand and gravel that was used in the construction of Interstate Highway 80, in the Humboldt area south of Imlay, and in reconstructing the Coal Canyon road northeast of Lovelock. Some stone for riprap was quarried and used in these projects. Gravel used in building construction and for fill was produced near Lovelock. County road crews produced nearly 52,000 tons of sand and gravel at various pit locations for road maintenance.

Iron ore shipments were made from five producing mines in the Buena Vista Hills area during 1962, but only three mines were active at yearend. New leasing arrangements made by the Southern Pacific Co., the owner, with Nevada-Barth Corp. became effective

January 1, subject to termination of existing leases extending through March 31. Involved in the transaction were Section 15 (Segerstrom-Heizer mine) and Section 29 (Thomas mine). In January, the former lessee on Section 15 shipped stockpiled ore mined in 1961, and Nevada-Barth reported production from the property throughout 1962. Dodge Construction, Inc., did not renew its lease on the Iron Horse group (Ford Prospect) after losing its lease on the nearby iron deposit in Section 29, in March. As a result, the Iron Horse operation was idle the rest of the year. Consolidated Minerals Corp. mined and shipped iron ore from deposits in Sections 16 and 22, adjacent to Section 15. Nevada Iron Ore Co., Inc., worked an iron deposit on its property in Section 32 (adjacent to Section 29) after March 31, and completed construction of a magnetic separation plant before yearend.

The Sugar Hill and Holliday tungsten claims, Seven Troughs district, were worked for a short time, and tungsten concentrates were shipped to the Nevada Scheelite tungsten carbide plant, Mineral County. Two other tungsten properties, the I Wonder in the Juniper district and the Wizard group of claims near Nixon, were idle. Late in 1962, Nevada-Massachusetts Co. auctioned all of its holdings at Tungsten except land, and allowed the mine workings to fill with water. The company had ceased operations in 1958. Its stockpiled tungsten concentrates were shipped to a California ammonium paratungstate plant during 1962. Only two mercury properties were active, the Freckles mine, Spring Valley district, and the Pershing mine, Antelope Springs district. Ore from the former yielded 51 flasks of mercury; ore from the latter, only 3 flasks.

Ores from three lode-gold mines and dump material at a fourth were the source of all the gold and some of the silver recovered in the county during 1962. Two of the mines, the Buck & Charlie and the Troy, are in the Rochester district. The third, the Seven Troughs mine, is in the Seven Troughs district. The mining district in which the dump material was located was not disclosed. Silver ore shipped from the Wabash mine, Rochester district, to a California smelter yielded silver, lead, and zinc. Stream gravels of the Willow Creek (Wadley) placer property were worked by dragline the last half of 1962, and gold and silver were recovered.

Storey.—Eagle-Picher Co. at its Clark Siding plant produced nearly 38 percent of the prepared Nevada diatomite sold in 1962. The crude material was mined at the company's nearby Celatom deposit. The plant products were sold to domestic and foreign consumers for various industrial uses. Naturalite Co. of Carson City, Nev., developed a new volcanic ash deposit northeast of Dayton. The pearl gray material was sold as lightweight aggregate and cut into blocks for decorative building stone.

Gold ore from the Silver Hill mine, Comstock district, was treated by amalgamation to recover gold and silver. It was the only active lode mine in the county during 1962. The Iron Blossom iron ore prospect, southwest of the Dayton iron deposit, was activated in 1962. Iron ore was mined and shipped for export from the property until the middle of August, when it was shut down.

Washoe.—Lesser tonnages of sand and gravel were required for paving projects and road construction in 1962. As a result, production of these materials declined about 100,000 tons from the 1.2-million-ton total of 1961. Construction on Interstate Highway 80, east of Sparks and near the California border, was the sole major project in 1962. City street and county road projects were reported at a much reduced level from 1961. A small tonnage of miscellaneous stone was quarried for riprap in State highway repair and maintenance. Commercial operators of sand and gravel preparation plants in the Reno area produced larger quantities of concrete aggregate for building construction, despite a 6-week carpenters' strike in northern Nevada at midyear. Double Check Products Co. quarried calcareous marl near Flanigan, principally for use in preparing animal feeds. No shipments of marl were made from the deposit near Pyramid Lake. Reno Press Brick Co. mined fire clay and miscellaneous clay from its Faith-Geiger pits, near Steamboat Springs, and used the materials to manufacture brick and heavy clay products in its Reno plants. United States Gypsum Co. operated its Empire plaster mill and wallboard plant near Gerlach, using gypsum from its nearby quarry in Pershing County. Crude perlite from the company's Pearl Hill stockpile, Pershing County, was expanded at its Empire plant.

P&J Mining Co. treated gold ore from the Sunbeam mine, Olinghouse district, and recovered gold and silver using amalgamation.

White Pine.—Kennecott Copper Corp. worked its Liberty pit, Robinson district, treated the recovered ore, and stockpiled ore from the Veteran pit in its nearby McGill copper concentrator and smelter. Copper ores from this district yielded most of the recoverable copper, gold, and silver. The State's entire output of molybdenum was recovered as a byproduct flotation concentrate in the treatment of these copper ores. The Kansas mine, Aurum district, was the source of copper ore yielding copper and silver. Lead ore mined from the Hamilton mine and copper-lead-zinc ore from the Grand Prize mine, White Pine district, were shipped to a Utah smelter for recovery of silver, copper, lead, and zinc. The Hamilton mine also yielded a few ounces of recoverable gold. Silver ore mined at the Silver King (Ward Group) property was shipped to Midvale, Utah, for concentrating before smelting. Gold, silver, and copper were recovered from the concentrates. The Willard mine, Robinson District, was worked for zinc ore which was processed at a Utah smelter and slag plant to recover zinc, lead, silver, and gold. Holders of stockpiled tungsten concentrates, from the Everit (Minerva Scheelite Mining Co.) mine, shipped to the tungsten carbide plant in Mineral County.

Compared with 1961, increased tonnages of sand and gravel and miscellaneous stone, were produced by contractors principally for construction of State Route 18A (U.S. Highway 50 to Strawberry) and U.S. Highway 6 (Murray Summit to Ely). Angelo T. Beck produced sand and gravel near Ely for use in county roads and other projects in the Ely area. General Contracting Corp., Salt Lake City, Utah, used portable equipment to prepare gravel for a National Park

Service road. Quartzite was quarried near Hendry Creek, north of Baker, by Star Dust Mines, Inc., and shipped to stone masons and building material dealers in Utah, California, and Montana. The quartzite was used for flagging and dimension building stone. Clays dug from the McDonough clay beds, near East Ely, were sold to Kennecott Copper Corp. for refractory use at the McGill copper smelter.

The Mineral Industry of New Hampshire

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the New Hampshire Department of Resources and Economic Development for collecting information on all minerals except fuels.

By Stanley A. Feitler [1] and Mary E. Otte [2]

VALUE of mineral production was 10 percent higher than that of 1961 and set a new record for New Hampshire. The importance of highway and building construction as markets for mineral raw materials produced in the State was demonstrated by the fact that 92 percent of the total value of mineral production was used in construction. The production of sheet mica which had been the second most valuable commodity during 1957–61 dropped to third place in 1962. The Federal domestic mica purchase program ended June 7, and mica mining was discontinued because the value of mica on the world market was below New Hampshire production costs.

TABLE 1.—Mineral production in New Hampshire [1]

Minera	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Beryllium concentrate ---- short tons	23	$14	7	$4
Clays ---- do	29,810	30	37,115	37
Feldspar ---- long tons	10,290	62	(3)	(3)
Mica:				
Sheet ---- pounds	[3] 105,943	1,009	35,450	374
Scrap ---- short tons	669	20	411	11
Peat ---- do	15	(2)		
Sand and gravel ---- do	7,701,266	3,627	8,260,453	4,119
Stone ---- do	116,920	684	154,389	1,368
Value of items that cannot be disclosed:				
Gem stones and values indicated by footnote 2		20		97
Total		[3] 5,466		6,010

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Revised figure.

[1] Mining engineer, Bureau of Mines, Pittsburgh, Pa.
[2] Statistical clerk, Bureau of Mines, Pittsburgh, Pa.

Legislation and Government Programs.—Strategic minerals of domestic origin were purchased for the Federal stockpile by General Services Administration (GSA) at depots in Franklin, N.H.; Spruce Pine, N.C.; and Custer, S. Dak. The program started in 1952 ended June 1962. Exploration, encouraged by the premium prices offered under this program, resulted in the discovery of a few new mines in New Hampshire, but most of the minerals were recovered from mines that had been worked previously.

Accelerated highway construction programs sponsored by the State and cooperatively by the State government and Federal Government stimulated the market for construction materials supplied by the mineral industry.

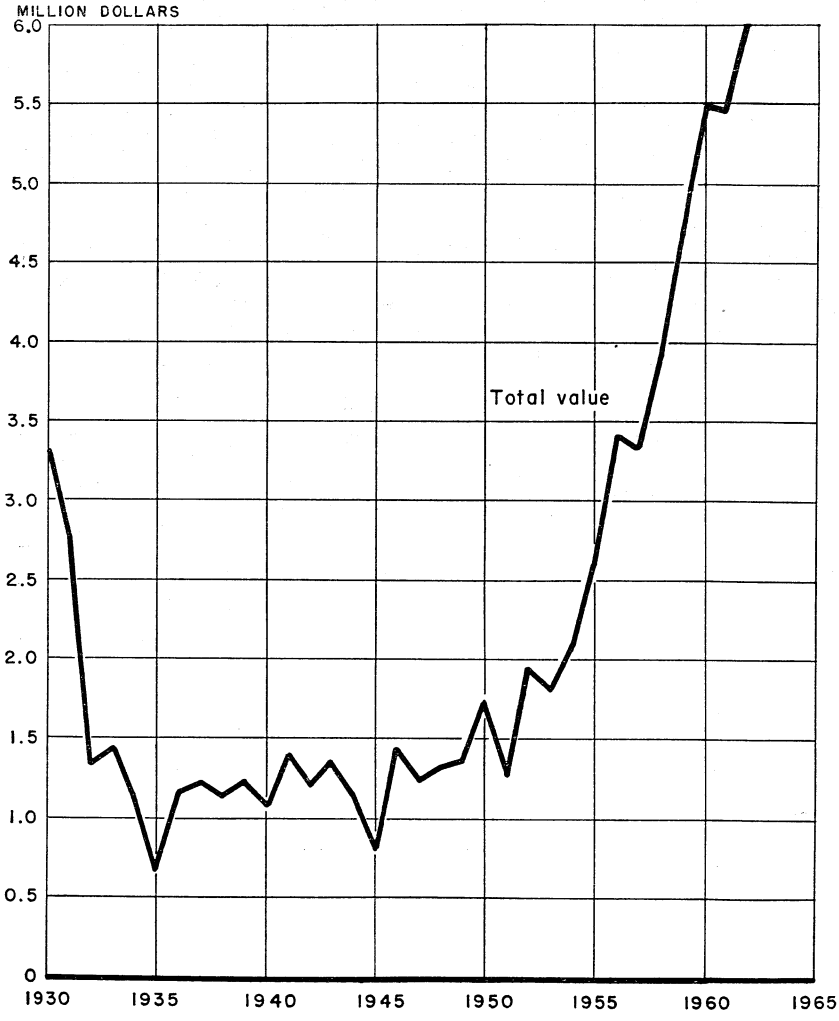

FIGURE 1.—Total value of mineral production in New Hampshire, 1930–62.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Output of miscellaneous clay for manufacturing building brick was 25 percent higher than in 1961. Clay was produced by brickmakers from pits in Rockingham and Grafton Counties.

Feldspar.—Pegmatite rock mined in Sullivan County was hauled by truck to the Golding-Keene Co. mill at Alstead where it was beneficiated and ground for ceramic use. Principal destinations of the ground material were New York, Ohio, Massachusetts, and Connecticut; smaller quantities were shipped to five other States. Selectively mined, hand-sorted potash feldspar from Carroll and Grafton Counties was hauled by truck to a grinding mill in Oxford County, Maine.

Gem Stones.—Most of the gem stones and mineral specimens in New Hamsphire were collected by amateurs but sales to gem and mineral dealers were made by miners and prospectors on an intermittent, as-available basis. Material was recovered from most counties in the State.

Mica.—Another cycle of mica mining in New Hampshire was completed in June 1962 when the domestic mica purchase program ended. The quota for mica purchases, which had been set under the program at 25,000 tons of hand-cobbed mica or the equivalent full-trim mica, was filled. New Hampshire mines contributed 548,000 pounds of sheet mica valued at $5.6 million. Table 2 summarizes the annual sales of New Hampshire sheet mica to GSA during the purchase program.

Purchases of mica by GSA were limited to the first 6 months of 1962 and decreased 69 percent in quantity, measured in pounds of full-trim mica, and 63 percent in value compared with 1961. The average value of strategic quality hand-cobbed mica was $1,328.35 per ton. Production was reported from 23 mines: In Grafton County, 12; in Cheshire County, 9; and in Merrimack and Sullivan Counties, 1 each.

Sales of wet ground mica increased substantially; the average value per ton was virtually unchanged. Most of it was used in the manufacture of paint, wallpaper, and rubber. Scrap mica for grinding originated in India, South Africa, and mines and mica trimming shops in New England.

TABLE 2.—Sheet mica sold to GSA under the purchase program ended June 7, 1962 [1]

Year	Pounds	Value (thousands)	Year	Pounds	Value (thousands)
1952–56 (average) [2]	19,804	$194	1960	77,077	$1,026
1957–58	125,535	1,081	1961	98,409	1,001
1959	116,881	1,132	1962	30,960	373

[1] Includes yield of full-trim from hand-cobbed mica.
[2] First sale at Franklin Depot in August 1952.

Peat.—No production was reported as the only peat producer in the State was idle.

Sand and Gravel.—Output of sand and gravel increased 7 percent in tonnage and 14 percent in value compared with 1961. The quantity of commercially produced sand and gravel for building construction was substantially higher than in 1961 but the value per ton was lower. Production of a quantity of filtration and engine sand was reported from Merrimack County. Consumption of sand and gravel for highway construction amounted to 89 percent of the total State tonnage.

Daily trainload shipments of bank run sand and gravel from a pit in Strafford County were continued. The material was delivered to the Boston area for highway construction. Low production costs and a favorable freight rate based on large daily shipments made this material competitive with sand and gravel produced in the Boston area. Crews of the Concord Commissioner of Public Works in Merrimack County and the Manchester Highway Department in Hillsboro County produced sand and gravel for highway construction and maintenance.

TABLE 3.—Sand and gravel, and stone production by Government-and-contractor operations, by counties

(Short tons)

County	Sand and gravel		Stone	
	1961	1962	1961	1962
Belknap	128,754	45,881		
Carroll	123,182	198,869		18,459
Cheshire	219,954	158,034	1,261	2,947
Coos	248,475	483,003	1,033	10,848
Grafton	1,024,562	342,255	7,251	5,818
Hillsboro	856,442	399,736	11,817	
Merrimack	810,341	1,222,929	841	10,087
Rockingham	537,830	540,420	1,492	358
Strafford	1,346,347	1,637,719		
Sullivan	481,255	159,431	8,800	983
Unspecified		677,700		
Total	5,777,142	5,865,977	32,495	49,500

Stone.—Both quantity and value of stone production increased sharply as compared with 1961. Part of the increase in value resulted from a change in the basis of valuation; some dimension stone which previously had been reported at the value of rough quarry block was reported at the finished value. All dimension stone was reported on the same basis in 1962. Granite blocks from the Gray quarry of John Swenson Co., Inc., were finished to rough and dressed architectural stone, monument stone, and curbing at the Concord finishing plant. Rough granite blocks from other States also were processed at the Swenson plant. Granite from the Kitledge quarry in Hillsboro County was cut and dressed for use in construction, architectural use, and monumental use at the finishing plant of Barretto Corp. in Milford. Barretto also produced curbing, paving blocks, and durax blocks. Crews of the New Hampshire Department of Public Works and Highways mined and crushed granite in seven counties for use as riprap and fill. Miscellaneous stone, mined in

Rockingham County, was prepared for use as riprap, concrete aggregate, and roadstone.

METALS

Beryllium.—Mining came to a virtual stop in June when the strategic mineral purchase program ended. The quantity of hand-cobbed beryl, sold to GSA for the national stockpile, was 70 percent lower than in 1961. Beryl was recovered by 10 producers from mines in Cheshire, Grafton, Merrimack, Rockingham, and Sullivan Counties. The average value of beryl sold to GSA was $0.28 per pound; average beryllium oxide content exceeded 11 percent.

REVIEW BY COUNTIES

Sand and gravel and stone produced by Government-and-contractor operations are shown by county in table 3 and are not included under the individual county reports that follow.

Belknap.—Tilton Sand & Gravel, Inc., Tilton, produced and sold building and paving sand and gravel, sand for fill, and gravel for dry wells and drainage systems. The Perkins Peat Bog operation near Center Barnstead was idle.

Carroll.—Building and paving sand and paving gravel were produced by Sparks Construction Co., Ossipee, and Alvan J. Coleman, Conway. Lester Wiley mined potash feldspar at the Chandler mine near Chatham. Hand sorted feldspar was delivered by truck to a grinding mill at West Paris, Maine. Collectors of gem stones and mineral specimens recovered smoky quartz crystals from vugs in the Conway granite, and aquamarine, tourmaline, and beryl from pegmatites. Granite in the White Mountains near Berlin was investigated as a possible source of thorium and uranium.

TABLE 4.—Value of mineral production in New Hampshire, by counties

County	1961	1962	Minerals produced in 1962, in order of value
Belknap	(1)	(1)	Sand and gravel.
Carroll	(1)	(1)	Sand and gravel, stone, feldspar, gem stones.
Cheshire	[2] $701,027	$595,912	Sand and gravel, mica, stone, beryllium.
Coos	112,998	(1)	Sand and gravel, stone.
Grafton	[2] 1,457,759	675,001	Sand and gravel, mica, clays, stone, feldspar, beryllium, gem stones.
Hillsboro	605,991	1,165,333	Stone, sand and gravel.
Merrimack	1,378,045	1,535,736	Sand and gravel, stone, mica, beryllium.
Rockingham	(1)	449,095	Sand and gravel, stone, clays, beryllium.
Strafford	365,562	(1)	Sand and gravel.
Sullivan	200,826	120,513	Feldspar, sand and gravel, stone, beryllium, mica.
Undistributed [3]	[2] 643,703	1,468,432	
Total	[2] 5,466,000	6,010,000	

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Revised figure.
[3] Includes value of beryllium, gem stones, mica, and sand and gravel (1962) not assigned to specific counties and value indicated by footnote 1.

Cheshire.—Sand and gravel for building, paving, and fill was produced by Cold River Sand & Gravel Corp., North Walpole, and Keene Sand & Gravel, Inc., Swanzey. All the material was transported to consumers by truck. Cheshire County continued to rank second in sheet mica production. Mica was recovered near Alstead

from the French, French No. 2, Blister, and Webster mines. Near Gilsum, mica was mined at the Clarke, Big, Isham, and Gilsum No. 2 mines. Most of it was sold to GSA for the Federal stockpile. Golding-Keene Co. operated the Yuhas mine in Sullivan County to supply feldspar to its Alstead grinding mill. The mixed potash-soda feldspar was beneficiated and ground for use in the manufacture of a variety of ceramic products. Quantity and value of beryl output decreased, although three mines were active as compared with two in 1961. The beryl was sold to GSA.

Coos.—Lessard Sand & Gravel Co., Gorham, produced building and paving sand and gravel; Clyde B. Gray, Colebrook, recovered gravel for fill and paving; and Fred Corrigan produced sand for building, paving, and fill from a pit near Randolph. The Maine Central Railroad's Colebrook sand and gravel pit was idle.

Grafton.—Sand and gravel recovered from pits near West Campton, Littleton, Plymouth, and West Lebanon was processed and used mainly for building and paving. Some gravel for fill also was recovered. Grafton County continued to lead the State in output of strategic mica. Production was reported from 12 mines located principally near Groton, Grafton, Orange, and Wentworth. For several years, the Keyes mine in the northwest corner of Orange Township had been one of the leading producers of strategic quality mica in the State. Densmore Brick Co., Lebanon, mined and processed miscellaneous clay for manufacturing building brick.

Potash feldspar recovered at the Ruggles mine, Grafton, was delivered to a grinding mill at West Paris, Maine. Hand-cobbed beryl produced at the Nancy mine, Groton; Pattuck mine, Alexandria; and the Ruggles mine, Grafton was sold to GSA. A variety of gem stones and mineral specimens was recovered by amateurs and dealers. Radioactive minerals, including autunite, torbernite, and uraninite, were collected near Groton and Grafton.

Hillsboro.—This county rose in value of mineral production from fourth place in the State in 1961 to second place. Rough blocks of granite from the Kitledge quarry near Milford were cut and dressed in the Milford finishing plant of Barretto Granite Corp. for use as dressed architectural and construction stone, monuments, and curbing. Sand and gravel, chiefly for building and paving, was produced by Robie Construction Co., Inc., and J. J. Cronin Sand & Gravel, both near Manchester, The Harris Construction Co., Inc., Peterborough, and Robert L. Robichard near Brookline.

Merrimack.—The county ranked first in value of mineral production, replacing Grafton County. Sand and gravel recovered from a pit at Hookset by Manchester Sand, Gravel & Cement Co. was used mainly for building and paving, but some filtration and engine sand was sold. Ninety-five percent of the output was washed and screened before shipment. Crude granite blocks from the Gray quarry were processed at the John Swenson Co., Inc., finishing plant. The principal products were architectural stone, slabs for monuments, and curbing. Mica from the Brownell mine, Danbury, and beryl from the North Star mine, Wilmot, were sold to GSA. Concord Mica Corp., Penacook, continued to produce finely ground mica by a wet, batch process.

Grinding was by oaken mullers in oaken tubs to yield a finely ground product having a high sheen.

Rockingham.—Building sand and gravel for paving and fill was produced by L. Chester and Clayton W. Simpson, Exeter. Manchester Sand, Gravel & Cement Co., Inc., Raymond, and Landers & Griffin, Inc., Londonderry, recovered sand and gravel for use as fill. Iafolla Crushed Stone Co., Inc., Portsmouth, quarried and prepared miscellaneous stone for concrete aggregate, roadstone, and riprap. Miscellaneous clay for manufacturing building brick was recovered from open pits by Eno Brick Corp., Exeter, and W. S. Goodrich, Inc., Epping. Beryl recovered from the Chandler mine near Raymond was sold to GSA at Franklin. Crude perlite mined in Colorado was expanded by National Gypsum Co. at its Portsmouth plant for use in building plaster. Macallen Co., Inc., Newmarket, fabricated mica in a variety of forms for industrial uses.

Strafford.—Building and paving sand and gravel and miscellaneous gravel were recovered by Dover Sand & Gravel, Inc., Dover, and James S. Pike, Durham.

Sullivan.—Golding-Keene Co. mined pegmatite at the Yuhas mine near Acworth to obtain feldspar for the company grinding plant at Alstead in Cheshire County. Beryl recovered as a coproduct of the feldspar was sold to GSA at Franklin. A small quantity of full-trim mica from the Ledge Pond mine also was sold to GSA.

The Mineral Industry of New Jersey

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the New Jersey Division of Resource Development, Bureau of Geology and Topography, for collecting information on all minerals except fuels.

By Charles C. Yeloushan [1] and Michael E. Bursic [2]

MINERAL production in New Jersey was valued at $65.7 million, 11 percent above that of 1961, establishing a record high. The $6.4 million increase was attributed mainly to the additional value of recoverable zinc from the reopened Sterling Hill mine in Sussex County and to the greater demand for stone in highway and building construction. Sand and gravel and stone accounted for 76 percent of the total value of mineral production in the State. Increases in total value from 1961 were reported for stone, sand and gravel, peat, zinc, lime, and greensand marl. Decreases in total value were reported for clays, iron ore, manganiferous residuum, and magnesium compounds. Production values for ilmenite were reported for the first time.

TABLE 1.—Mineral production in New Jersey [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays—thousand short tons	657	$1,681	584	$1,476
Gem stones	(2)	9	(2)	9
Peat—short tons	21,257	212	26,066	247
Sand and gravel—thousand short tons	12,257	20,895	13,728	21,230
Stone—do	11,315	24,539	14,214	28,979
Zinc [3] (recoverable content of ores, etc.)—short tons	112	26	15,309	3,559
Value of items that cannot be disclosed: Iron ore, lime, magnesium compounds, manganiferous residuum, greensand marl, titanium concentrate (ilmenite)	----------	[4] 11,908	----------	10,186
Total	----------	[4] 59,270	----------	65,686

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at the mine.
[4] Revised figure.

[1] Mining engineer, Bureau of Mines, Pittsburgh, Pa.
[2] Statistical clerk, Bureau of Mines, Pittsburgh, Pa.

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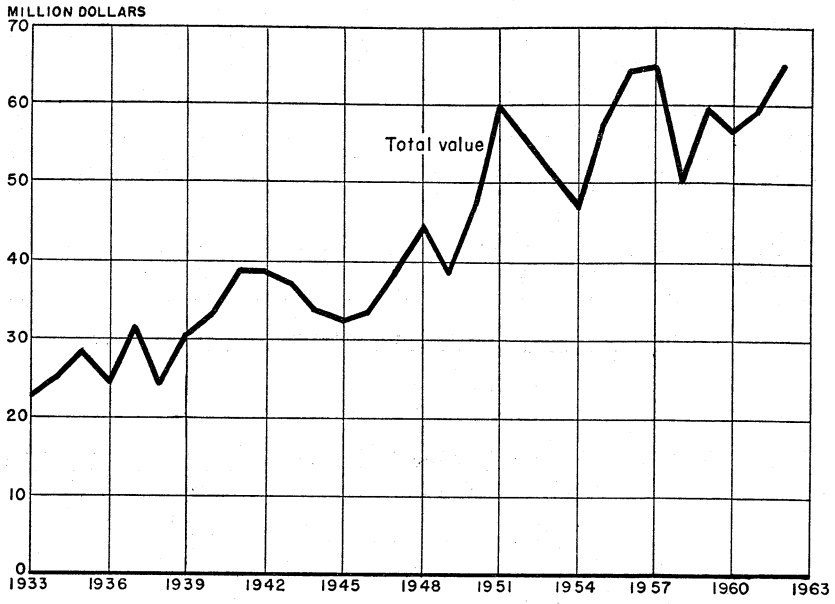

FIGURE 1.—Total value of mineral production in New Jersey, 1933–62.

Employment and Injuries.—Employment indicated by preliminary data increased in all categories as shown in table 2. Sand and gravel reported the greatest increase in men working daily. Quarries and mills showed the greatest increase in man-hours worked. Three fatalities were reported in 1962. Injuries per million man-hours declined slightly.

TABLE 2.—Employment and injuries in the mineral industries[1]

Industry	Men working daily	Man-hours worked	Injuries		
			Fatal	Nonfatal	Per million man-hours
1961:					
Sand and gravel	1,052	2,154,796	----------	34	16
Quarries and mills	950	1,780,511	----------	94	53
Nonmetal mines[2]	61	64,733	----------	2	31
Metal mines and mills	439	792,459	----------	11	14
Total	2,502	4,792,499	----------	141	29
1962:[3]					
Sand and gravel	1,177	2,342,000	1	45	20
Quarries and mills	1,030	2,079,000	2	34	17
Nonmetal mines[2]	63	67,000	----------	7	104
Metal mines and mills	541	873,000	----------	54	62
Total	2,811	5,361,000	3	140	27

[1] Excludes officeworkers.
[2] Includes clays, greensand marl, and magnesium compounds.
[3] Preliminary figures.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Total production of fire clay and miscellaneous clay decreased 11 percent in tonnage and 12 percent in value from 1961. Miscellaneous clay accounted for most of the tonnage but fire clay contributed most of the value. Fire clay was produced in Cumberland and Middlesex Counties and miscellaneous clay was mined chiefly in Middlesex and Somerset Counties with a small production in Bergen, Burlington, Camden, Morris, Passaic, and Warren Counties. Most of the fire clay was of the plastic variety and used mainly for manufacturing refractory products. Other varieties of fire clay were produced in small quantities and used for pottery, stoneware, abrasives, floor and wall tile, architectural terra cotta, vitrified sewer pipe, filler, and rotary-drilling mud. Miscellaneous clay was used principally for building brick and other heavy clay products. Clay production was reported from 21 operations compared with 24 operations in 1961.

Gem Stones.—Mineral deposits in the Franklin area, Sussex County, continued to attract thousands of amateur mineral and gem collectors because of the large quantity and variety of mineral specimens available from old mine dumps. Various mineral specimens were also obtained in small quantities from other areas throughout the State.

Gypsum.—Production of calcined gypsum was reported by two companies for the manufacture of plaster, wallboard, sheathing, lath, and other materials. Crude gypsum for these operations was obtained from out-of-State operations.

Lime.—Hydrated lime was produced for construction, agricultural, and chemical purposes by one company in Sussex County. Production was slightly higher than in 1961.

Magnesium Compounds.—Refractory magnesia was produced from a combination of raw sea water and dolomite in Cape May County. Total output of magnesium compounds decreased 11 percent from 1961.

Marl, Greensand.—The quantity of greensand marl shipped from Burlington and Gloucester Counties decreased 21 percent although the total value increased 2 percent from 1961. The product was used as a soil conditioner and as a water softener.

Perlite.—Crude perlite mined in Southwestern United States was expanded at plants in Middlesex, Passaic, Somerset, and Union Counties for use in building plaster, lightweight concrete, pipe-covering insulation, and as a filler and soil conditioner.

Pigments.—Manufactured red iron oxide pigments were produced at plants in Middlesex and Mercer Counties. Hydrated ferric oxide pigments were manufactured in Essex County. Manufactured magnetic black, brown iron oxide, and yellow iron oxide pigments were produced in Mercer County.

Sand and Gravel.—Production of sand and gravel increased 12 percent in quantity and 2 percent in value from 1961 and accounted for 32 percent of the total value of mineral production in the State. Of the fourteen counties reporting production, Cumberland County led, followed by Bergen, Burlington, Camden, Middlesex, Morris, and Ocean Counties. Each of these counties contributed over $1 million

of sand and gravel to the State total. Consumption by commercial structural and paving operations accounted for 74 percent of the tonnage. The quantity of sand used for molding purposes increased 17 percent from 1961. Sand also was used for glass, blast, fire or furnace, engine, filtration, filler or other purposes. Ground sand was used for abrasives, chemical, filler, glass, foundry, pottery, and other uses.

TABLE 3.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Structural	3,961	$4,875	4,465	$4,465
Paving	2,160	1,792	2,534	2,000
Fill	293	112	(1)	(1)
Glass	(1)	(1)	683	2,595
Molding	1,291	4,147	1,509	4,788
Grinding and polishing			19	54
Blast	138	620	107	550
Fire or furnace	17	38	8	22
Engine	27	80	29	96
Filtration	28	95	10	51
Filler	(1)	(1)	43	369
Other [2]	935	4,102	776	1,568
Total	8,850	15,861	10,183	16,558
Gravel:				
Structural	2,133	3,554	1,899	2,997
Paving	994	1,249	1,254	1,401
Fill	189	87	271	127
Other [3]	80	139	90	135
Total	3,396	5,029	3,514	4,660
Total sand and gravel	12,246	20,890	13,697	21,218
Government-and-contractor operations:				
Sand:				
Paving			3	1
Other			5	2
Total			8	3
Gravel: Paving	11	5	23	9
Total	11	5	23	9
Total sand and gravel	11	5	31	12
All operations:				
Sand	8,850	15,861	10,191	16,561
Gravel	3,407	5,034	3,536	4,669
Grand total	12,257	20,895	13,728	21,230

[1] Included in "Other."
[2] Includes ground and other sand.
[3] Includes other and miscellaneous gravel.

Stone.—Total value of all types of stone increased 18 percent over 1961 and accounted for 44 percent of the total value of mineral production in the State. The principal stone quarried was basalt (traprock), which comprised 90 percent of the total stone tonnage and 83 percent of the total stone value. Basalt was produced in seven counties but Somerset, Bergen, and Passaic Counties accounted for 85 percent of the production. Basalt was used chiefly as concrete

aggregate and roadstone, but some also was used for riprap, railroad ballast, and miscellaneous purposes. Granite was quarried in Hunterdon and Morris Counties by four companies and crushed for use as riprap, concrete aggregate, roadstone, and railroad ballast. Limestone was produced by two companies in Sussex County and was used mainly for concrete aggregate, roadstone, and agricultural purposes. Oystershell was recovered and ground in Gloucester County for poultry grit and lime. Marble was quarried in Warren County and crushed for use in flooring made of small chips of marble set irregularly in cement and polished. Miscellaneous stone was produced in Passaic County for concrete aggregate and roadstone and in Hunterdon County for rough dimension building stone.

Roofing Granules.—Production of roofing granules increased over 1961—36 percent in tonnage and 65 percent in value. Natural and artificially colored granules were produced in Bergen, Passaic, and Somerset Counties. Five companies reported production. Basalt (traprock) quarried in the State provided most of the raw material.

Sulfur.—Shipments of sulfur, used in manufacturing sulfuric acid and in other chemical processes, decreased less than 1 percent from 1961. Brimstone (sulfur) was recovered as a byproduct in the liquid purification of gas by various processes. Production reported by four plants totaled 45,500 long tons. Shipments totaled 45,600 tons and were valued at $1,019,300. Two plants were located in Gloucester County and one each in Middlesex and Union Counties.

Vermiculite.—Production of exfoliated vermiculite decreased 10 percent from 1961. Plants were located in Essex and Mercer Counties. The product was used for insulation, concrete and plaster aggregate, and agricultural chemical purposes.

METALS

American Smelting and Refining Co. operated a producing plant at Perth Amboy and a research laboratory at South Plainfield, both in Middlesex County. The Perth Amboy plant produced antimony oxide, refined and high purity bismuth, continuous cast bronze, refined copper, refined indium, refined nickel salts, sponge platinum, sponge palladium, and refined silver. The South Plainfield research laboratory produced high purity antimony, arsenic, and indium, and research quantities of high-purity copper, lead, and zinc. Federated Metals Division of American Smelting and Refining Co. operated plants at Perth Amboy in Middlesex County, at Newark in Essex County, and at Trenton in Mercer County. The Perth Amboy plant produced various copper alloys and fabricated lead products. The Newark plant produced solders, copper hardeners, copper shot, type metals, magnesium alloys, fabricated lead, low-melting alloys, fabricated indium, fusible alloys and babbitts. The Trenton plant produced zinc dust.

United States Metals Refining Co. produced copper, gold, silver, and solder at its Carteret plant. Aetna Smelting and Refining Works, Inc. produced lead, lead alloys, solder, and babbitt at its Jersey City plant. Kearny Smelting and Refining Corp. produced brass and bronze ingot and shot at its Kearny plant. National Lead Co.

produced antimonial and soft lead, solders, babbitts, and ingot lead at its Perth Amboy plant. International Smelting and Refining Co. produced refined copper, cathodes, and cast shapes at its Perth Amboy plant.

Iron Ore.—Shipments of usable iron ore decreased 3 percent in quantity and 19 percent in value. Magnetite ore produced at two underground mines, one in Morris County and one in Warren County, was beneficiated magnetically to an iron concentrate. Most concentrates were sent by railroad to blast furnaces at Conshohocken, Pa., for steelmaking, but part was ground and sold for use in powder metallurgy.

Titanium.—Ilmenite concentrate was produced by The Glidden Co. at its Lakehurst mine in Ocean County. Shipments were made to its Pigments Division at Baltimore, Md., for conversion to titanium dioxide.

Zinc.—Mining was resumed at the Sterling Hill underground zinc mine in Sussex County. Concentrate was shipped to the smelter at Palmerton, Pa.

MINERAL FUELS

Coke and Coal Chemicals.—Koppers Co., Inc., operated a merchant plant for coke and coal chemicals in Hudson County. Byproducts recovered at the plant included ammonium sulfate, crude coal tar, crude and intermediate light oil, naphthaline, and monoammonium phosphate.

Peat.—Quantity of peat recovered from bogs in Sussex and Warren Counties increased 23 percent from that of 1961, although total value of peat increased only 17 percent. Most of the peat was sold in bulk form for use as a soil conditioner.

Petroleum.—Seven of eight petroleum refineries in New Jersey were active in 1962. Daily operating capacity of crude-oil distillation decreased from 538,750 barrels on January 1, 1961, to 528,150 barrels on January 1, 1962. Daily operating capacity of gasoline cracking and reforming plants increased from 133,600 barrels on January 1, 1961, to 142,100 barrels on January 1, 1962. Petroleum research on production development, product utilization, and new processes was conducted at the following locations: Esso Research Center at Linden; Cities Service Research & Development Co. at Cranberry; Socony-Mobil Oil Co., at Paulsboro; and Esso Research & Engineering Center at Florham Park.

TABLE 4.—Capacities of petroleum refineries and cracking plants, January 1, 1962

(Barrels per day)

Company	Location	Type of plant [1]	Crude-oil capacity		Cracking capacity		Reforming capacity	
			Operating	Shut down	Gasoline output		Gasoline output	
					Operating	Shut down	Operating	Shut down
	Gloucester County:							
Mobil Oil Co	Paulsboro	S-C-K-L	77,400	--------	10,200	--------	13,000	--------
Texaco, Inc	Westville	S-C	74,000	--------	14,200	--------	10,300	--------
	Middlesex County:							
California Oil Co	Perth Amboy	S-C-A	100,000	15,500	10,200	200	9,000	6,500
Hess Oil & Chemical Co.[2]	Sewaren	S-C	71,250	--------	18,000	--------	3,500	--------
	Union County:							
Metropolitan Petroleum Corp.	Bayonne	S	---------	20,000	--------	--------	--------	--------
Humble Oil & Refining Co.	do	S-A	22,500	--------	--------	--------	--------	--------
Do	Linden	S-C-A	168,000	--------	38,200	--------	15,500	--------
Cities Service Oil Co	do	S-A	15,000	--------	--------	--------	--------	--------
Total	----------	----------	528,150	35,500	90,800	200	51,300	6,500

[1] Type of plant: A—Asphalt, C—Cracking and/or reforming, K—Coking, L—Lube, and S—Skimming.
[2] Oil and Gas Journal. 60, No. 12.

TABLE 5.—Value of mineral production in New Jersey by counties [1]

County	1961	1962	Minerals produced in 1962 in order of value
Atlantic	$187,876	$255,357	Sand and gravel.
Bergen	2,851,835	5,848,844	Stone, sand and gravel, clays.
Burlington	2,123,662	1,455,561	Sand and gravel, greensand marl, clays.
Camden	2,091,686	1,623,093	Sand and gravel, clays.
Cape May	(2)	(2)	Magnesium compounds, sand and gravel.
Cumberland	7,925,390	8,512,685	Sand and gravel, clays.
Essex	(2)	(2)	Stone.
Gloucester	[3] 551,202	646,549	Sand and gravel, greensand marl, stone.
Hunterdon	(2)	(2)	Stone.
Mercer	(2)	(2)	Do.
Middlesex	2,114,217	2,380,096	Sand and gravel, clays.
Monmouth	667,982	767,619	Sand and gravel.
Morris	10,205,851	9,735,648	Iron ore, sand and gravel, stone, clays.
Ocean	1,459,486	1,821,931	Sand and gravel, ilmenite.
Passaic	5,781,938	5,704,998	Stone, sand and gravel, clays.
Somerset	10,545,215	11,460,768	Stone, clays, gem stones.
Sussex	[3] 3,744,167	7,571,430	Zinc, stone, manganiferous residuum, lime, sand and gravel, peat, gem stones.
Union	(2)	(2)	Stone.
Warren	(2)	1,732,429	Iron ore, sand and gravel, peat, stone, clays.
Undistributed [4]	9,019,294	6,169,052	
Total	[3] 59,270,000	65,686,000	

[1] No production reported in Hudson and Salem Counties.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.
[4] Includes value of gem stones, and sand and gravel (1961) not assigned to specific counties and values indicated by footnote 2.

REVIEW BY COUNTIES

Atlantic.—Sand and gravel production from commercial and Government-and-contractor operations increased 36 percent in total value above that of 1961. Production of sand and gravel from commercial producers totaled 179,000 tons, an 85 percent increase from that of 1961. Macrie's Sand & Gravel Co. at Hammonton and Oceanville Sand Co. at Oceanville produced sand for building purposes. Sand and gravel for building or paving purposes was produced by Walter A. Daminger at Hammonton, by Mizpah Sand & Gravel Co. at Port Republic, by Somers Point Sand & Gravel Co. at Somers Point, and by May's Landing Sand & Gravel Co. at Vineland. Molding sand for foundry use was produced by Taggart Brimfield Co. of Hammonton and by Tri-State Sand Co. of Millville at their Cedar Lake plants. Atlantic County Road Department produced sand and gravel for mixing patch material, sanding and regraveling roads, and fill at Pleasantville.

Bergen.—Basalt was produced for fill under a contract with the New Jersey State Highway Department for use in the construction of interstate highways. Sand and gravel production decreased 7 percent in total tonnage but decreased less than 1 percent in total value from 1961. Five companies produced sand and gravel for building and paving purposes mainly but some was used for fill and ice control on highways. Sand and gravel operations were located near Ossipee, Wyckoff, Ramsey, Mahwah, and Paramus. Tri-County Brick Corp. mined miscellaneous clay for use in manufacturing building brick near Moonachie. The Flintkote Co. produced artificially colored roofing granules at its East Rutherford plant. Barrett Division, Allied Chemical Corp., operated a calcined gypsum plant at South Kearney.

Burlington.—Total value of sand and gravel production decreased 32 percent from 1961. Sand and gravel production totaled 1.3 million tons from seven operations near Riverton, Bala-Cynwyd, Riverside, Burlington, and Mount Holly. Most of the production was used for building and paving purposes. Greensand marl was produced by National Soil Conservation, Inc., at Medford and sold to various purchasers for use as a soil conditioner. Church Brick Co. mined miscellaneous clay near Fieldsboro for use in manufacturing building brick. National Gypsum Co. had a calcined gypsum plant at Burlington.

Camden.—Sand and gravel production from commercial producers decreased 24 percent in total value. Tri-Borough Sand & Stone, Inc., produced large quantities of sand and gravel near Gibbsboro for building and paving purposes. Building and paving also consumed sand and gravel production from the following operations: Ward Sand & Materials Co. at Pennsauken Township; South Jersey Construction Co. at Chews Landing; and Buzby Brothers & Co., Inc., at Mount Ephraim. Sand for brick, block, and foundry was produced by Pine Valley Sand Co., Inc., at its Berlin plant. Gravel was produced by Camden County Highway Department for paving purposes near Lindenwold. The Alliance Clay Product Co. manufactured building brick from miscellaneous clay mined near Winslow Junction.

Cape May.—Northwest Magnesite Co. produced refractory magnesia from a combination of raw sea water and dolomite at its Cape May plant. Total value of sand and gravel production increased 1 percent above that of 1961, although total tonnage decreased 2 percent. Sand and gravel was processed for building purposes at Tuckahoe by Tuckahoe Sand & Gravel and at Cape May Court House by Courtland Sand & Gravel Co. John F. Gandy produced sand and gravel for paving purposes at its portable plant near Marmora.

Cumberland.—The county led 13 other counties in total sand and gravel tonnage and value. Sand and gravel production totaled 2.5 million tons. Industrial sand for manufacturing glass was produced by National Glass Sand Corp., Pennsylvania Glass Sand Corp., Daniel Goff Co., Inc., and Armstrong Cork Co., all near Millville, and by Jesse S. Morie & Son, Inc., near Mauricetown. Industrial sand for molding purposes only was produced by New Jersey Silica Sand Co. and Tri-State Sand Co., both of Millville, and by Whitehead Brothers Co. near Dorchester Dividing Creek. Other companies producing industrial sand were Port Silica Sand Co., Inc., and Millville Silica Sand & Gravel Co., Inc., both of Port Elizabeth; and by George F. Pettinos, Inc., at Manumuskin. Ground sand was produced by Pennsylvania Glass Sand Corp. near Millville for abrasives, chemical, filler, foundry uses, glass, pottery, and other uses. National Glass Sand Corp. produced ground sand near Millville for foundry uses, pottery, soaps, chemical, flooring, and other uses. Sand and gravel for construction was produced by Ricci Brothers, Washed Sand & Stone Co. at Port Norris; Brunetti Brothers at Vineland; and May's Landing Sand & Gravel Co. at Cedarville. Plastic fire clay was mined near Millville for use as molding sand bond by Daniel Goff Co., Inc.

Essex.—Basalt was quarried and crushed for concrete aggregate and roadstone by M. L. Kernan Quarry at South Orange and by Orange Quarry Co. at West Orange.

Hydrated ferric oxide pigments were manufactured by E. I. du Pont de Nemours & Co., Inc. at its Newark plant.

Vermiculite Industrial Corp. produced exfoliated vermiculite at its Newark plant.

Gloucester.—Total value of sand and gravel production increased 20 percent from that of 1961, although total tonnage decreased 6 percent. Sand and gravel production was reported by five companies at six operations. Wenonah Sand & Gravel Co. opened a new dredging operation at Repaupo in addition to their Mt. Royal dredging operation for producing sand and gravel for building purposes. L. R. Curtis produced sand for building purposes at his Bridgeport dredge. Industrial sand was processed at Downer by Downer Silica Co. for fire or furnace use. Buzby Brothers & Co., Inc., produced sand for building purposes at its Mount Ephraim plant. Crown Point Sand Co., Inc., produced sand for building and paving purposes at its Bridgeport plant.

Greensand marl was produced by Inversand Co. near Sewell and sold to various water treating equipment manufacturers to be used as a zeolite to soften and otherwise treat water.

Freeport Sulphur Co. recovered sulfur as a byproduct in the liquid purification of gas by the modified Baehr process at its Eagle Point

plant in Westville. The Claus process was used at the Paulsboro refinery of Socony Mobil Oil Co., Inc., to recover sulfur as a byproduct.

Hudson.—Byproduct chemicals were recovered at the Kearney coke and coal chemical plant of Koppers Co., Inc.

Hunterdon.—Houdaille Construction Materials, Inc., crushed basalt near Oldwick for concrete aggregate, roadstone, and slope protection at a damsite. Diabase (traprock or basalt) was quarried and crushed by Lambertville Quarry Co. at Lambertville for concrete aggregate, roadstone, and railroad ballast.

Delaware Quarries produced rough dimensional building stone near Lumberville.

Granite was crushed for riprap and roadstone near Clinton by Anthony Ferrante & Sons.

Mercer.—Diabase (traprock or basalt) was quarried and crushed for riprap, concrete aggregate, roadstone, and railroad ballast by Pennington Quarry Co., near Pennington. Mercer County Workhouse at Trenton reported crushed basalt production for riprap.

Columbian Carbon Co. produced manufactured brown, red, and yellow iron oxide pigments and magnetic black pigments at its Trenton plant. Zonolite Company produced exfoliated vermiculite at its Trenton plant.

Middlesex.—Sand and gravel production more than doubled in total tonnage and increased 39 percent in total value from 1961. Nine companies reported sand and gravel output. Sayre & Fisher Sand Co. constructed a new sand processing plant near Sayreville that had a production capacity of 500 tons per hour. Other large sand and gravel producers included Herbert Sand Co., Inc., East Brunswick; Dallenbach Sand Co., Inc., Milltown; Buck Brother, Inc., Edison; Crossman Co., Sayreville; and Raritan River Sand Co., Nixon. Most of the sand and gravel was used for building, paving, and fill. Ground sand was produced by South River Sand Co., at Old Bridge for abrasives, filler, and foundry uses, and unground sand was produced for blast, engine, and filtration use. Total value of clay production decreased 10 percent from that of 1961, but Middlesex County continued to lead 8 other clay-producing counties and accounted for 56 percent of the State tonnage. Fire and miscellaneous clay was produced by 11 companies, mainly along the Atlantic Seaboard, for use in manufacturing a variety of refractories, heavy clay products, floor and wall tile, architectural terra cotta, pottery, stoneware and lightweight aggregate, and for use as a filler, rotary-drilling mud, and abrasive. Manufactured red oxide pigments were produced by Stabilized Pigments, Inc., in its New Brunswick plant and by Columbian Carbon Co. in its Monmouth Junction plant. Crude perlite mined in New Mexico was expanded by Coralux Perlite Company of New Jersey at its Metuchen plant for use in building plaster and lightweight concrete. The Anlin Company of New Jersey recovered sulfur as a byproduct in the liquid purification of gas by the Amine gas purification and modified Claus processes at its Perth Amboy plant.

Monmouth.—Production of sand and gravel increased 7 percent in total tonnage and 15 percent in total value from 1961. Hause Gravel Co. produced large quantities of sand and gravel for ready-mixed

concrete at its Asbury Park plant. Bennett Sand & Gravel Co., Inc., also produced large quantities of sand and gravel for building and paving purposes at its Manasquan plant. Other sand and gravel operations were Fary's Gravel Pit Inc., New Shrewsbury; New Jersey Gravel & Sand Co., Inc., Farmingdale; Joseph Scarano, Wayside; Frank Z. Sindlinger, Inc., Wall Township; and Walling & Son, Hazlet.

Morris.—Alan Wood Steel Co. continued active mining on three levels and reactivated development on two other levels at its Scrub Oaks iron mine near Dover. Crushed stone, sand, and grit were sold as byproducts at this mine. Shahmoon Industries, Inc., shipped iron ore concentrate from stockpiles of material that had been mined and beneficiated in previous years at its Mt. Hope mine. Sand and gravel production decreased 4 percent in total value and 1 percent in total tonnage from 1961. Houdaille Construction Materials, Inc., with stationary plants at Kenvil and Riverdale produced large quantities of sand and gravel for building and paving. Other large sand and gravel producers were Samuel Braen's Sons, Pequannock; Berkshire Sand & Stone Co., Oak Ridge; Wharton Sand & Stone Co., Montville; Pequannock Sand & Gravel Division, Union Building & Construction Corp., Pequannock; and T. Landi & Sons, Inc., Morristown. Shahmoon Industries, Inc., produced crushed granite at its Mt. Hope quarry. Crushed granite was also produced by Braen Industries, Inc., at its Riverdale quarry. Flowerpots were manufactured by Logansville Pottery, Inc., from clay mined near Bernardsville.

Ocean.—Sand and gravel, produced at seven locations, increased in total tonnage and value from that of 1961. Large sand and gravel producers were Brick Wall Corp., Lakehurst; Atlantic Gravel Co., Toms River; and Houdaille Construction Materials, Inc., Lakewood. New Jersey Pulverizing Co. produced ground sand for abrasives, filler, and foundry uses, and unground sand for molding, blast, engine, and filtration uses at its Pinewald plant. The Glidden Co. completed construction of its concentrating plant for recovering ilmenite from the Lakehurst mine sands near Ridgeway. Production was reported for the first time in 1962.

Passaic.—Stone production decreased 2 percent in total tonnage and 3 percent in total value from that in 1961. Samuel Braen's Sons crushed basalt for riprap, concrete aggregate, and roadstone at its Hawthorne Division quarry near North Haledon and at its Haledon Division quarry near Haledon. Basalt was crushed for concrete aggregate and roadstone by Houdaille Construction Materials, Inc., at its Montclair plant; Sowerbutt Quarries, Inc., at its Paterson No. 1 plant near Prospect Park; and Union Building & Construction Corp. at its Valley Road quarry near Clifton. Gneiss was crushed for concrete aggregate and roadstone by Passaic Crushed Stone Co., Inc., at its Pompton Lakes quarry. Natural roofing granules were produced from basalt (traprock) at Little Falls by Great Notch Granule Co. and at Passaic by H. B. Reed Corp. for mineral-surfaced roofing and siding. Production of sand and gravel increased 18 percent in total value from that of 1961. Sand and gravel was recovered for building purposes at Wayne by Van Decker Bros., Inc., and

Herbert J. Hinchman & Son. Van Orden Sand & Gravel Co. produced sand and gravel for building and fill uses at its Wayne plant. Paterson Brick Co. mined miscellaneous clay near Wayne for the manufacture of building brick. Crude perlite, mined in Nevada, was expanded by PerAlex of New Jersey, Inc., at its Paterson plant for use in building plaster, lightweight aggregate, and for soil conditioning.

Somerset.—Basalt production continued to make Somerset County the leading stone-producing county in the State with 5.4 million tons valued at $11.3 million. Basalt was the only stone produced in the county, and production increased 14 percent over 1961. Houdaille Construction Materials, Inc., produced crushed basalt for riprap, concrete aggregate, and roadstone at its Bound Brook and Millington quarries. Basalt also was crushed for riprap, roofing granules, concrete aggregate, roadstone, and railroad ballast by Kingston Traprock Co. at its Kingston quarry, Fanwood Stone Crushing & Quarry Co. at its Watchung quarry, Somerset Crushed Stone, Inc. at its Bernardsville quarry, Minnesota Mining & Manufacturing Co. at its Belle Mead quarry, and Dock Watch Quarry Pit, Inc., at its Martinsville quarry. Minnesota Mining & Manufacturing Co. produced artificially colored roofing granules at its Belle Mead plant. Central Commercial Co. produced natural and artificially colored roofing granules at its Bound Brook plant. The plant was purchased by The Ruberoid Co. in July. Vitrified sewer pipe was manufactured from shale mined near Somerville by American Vitrified Products Co. Natco Corp. mined shale from its Middlebush pit for manufacturing building brick and other heavy clay products. New Jersey Shale Brick & Tile Corp. manufactured building brick from shale mined near Somerville. Crude perlite mined in Colorado was expanded by the industrial insulation Division of Johns-Manville Corp. at its Manville plant for use in the manufacture of pipe-covering insulation.

Sussex.—The Sterling Hill mine at Ogdensburg resumed mining on a full scale and shipped zinc concentrate to Palmerton, Pa., for smelting. The smelter also reported the production of manganiferous zinc residuum from this concentrate. Limestone Products Corporation of America produced crushed limestone for flux, concrete aggregate, roadstone, agricultural purposes, lime manufacture, rubber filler, asphalt filler, filter beds, mineral food, poultry grit, and other uses at its Lime Crest plant near Newton. Limestone was also crushed at the Franklin plant of Farber White Limestone Co. for concrete aggregate, agricultural purposes, plaster, asphalt filler, and roofing spar. Sand and gravel increased 12 percent in total tonnage, and was produced for building, paving, or fill purposes by Limestone Products Corp. near Newton; F. W. Bennett & Son near Lafayette; Andover Industries near Andover; and Sparta Sand & Gravel Co., Inc., near Sparta. Hyper-Humus Co. produced peat from bogs near Newton and sold it packaged and in bulk for soil conditioning. Only bulk peat was produced from bogs near Stanhope and sold by Netcong Natural Products. Mineral specimens were collected near Franklin and Ogdensburg from old mine dumps by many amateur mineral and gem collectors.

Union.—Basalt was quarried and crushed for concrete aggregate and roadstone at the Summit plant of Houdaille Construction Materials, Inc. Crude perlite mined in Colorado was expanded by Certified Industrial Products, Inc., at its Hillside plant for use in building plaster, and as a lightweight aggregate, and soil conditioner. Allied Chemical Corp. recovered sulfur as a byproduct in the liquid purification of gas by the general chemical process at its Bayway plant in Elizabeth.

Warren.—The Washington Mine of Alan Wood Steel Co. produced magnetite ore which was beneficiated magnetically to an iron concentrate and used in making steel at the company blast furnace at Conshohocken, Pa. Sand and gravel production increased 8 percent in total value and decreased 1 percent in total tonnage from that of 1961. Steckel Concrete Co. produced sand and gravel for ready-mixed concrete and fill at its Phillipsburg plant. Houdaille Construction Materials, Inc., processed sand and gravel at its Carpenterville plant for building and paving purposes. Van Horn Sand & Gravel Co. produced sand and gravel at its portable plant near Belvidere for building, paving, and fill. The Royal Green Marble Co., Inc., produced light green and royal green marble chips for terrazzo flooring at its Serpentine quarry near Phillipsburg. Humus peat was produced and sold in bulk form for agricultural purposes from a bog near Buttzville by Tamarack Humus Co. and from a bog near Great Meadows by Mt. Bethel Humus Co.

The Mineral Industry of New Mexico

By A. D. Hahn [1]

MINERAL production in New Mexico in 1962 was valued at $674.1 million, a decrease of $17 million, or a loss of 2 percent, compared with that of 1961. The value of the fuels group declined $7.8 million (from $454.3 to $446.4 million); nonmetals $13.5 million (from $119.3 to $105.8 million); but that of metals increased $4.4 million (from $117.4 to $121.8 million). Production

TABLE 1.—Mineral production in New Mexico [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite—short tons	600	$10	252	$4
Beryllium concentrate—short tons, gross weight	24	12	34	19
Carbon dioxide (natural)—thousand cubic feet	242,903	24	826,810	74
Clays—thousand short tons	[2] 67	[2] 165	52	156
Coal (bituminous)—do	412	2,477	677	2,595
Copper (recoverable content of ores, etc.)—short tons	79,606	47,764	82,683	50,933
Gem stones	[3]	46	[3]	45
Gold (recoverable content of ores, etc.)—troy ounces	6,201	217	7,529	264
Gypsum—thousand short tons	105	386	151	564
Helium—thousand cubic feet	42,224	762	27,377	958
Iron ore (usable)—thousand long tons, gross weight	[4]	[4]	9	121
Lead (recoverable content of ores, etc.)—short tons	2,332	480	1,134	209
Lime—thousand short tons	25	350	29	403
Mica (scrap)—short tons	1,800	52	5,731	140
Natural gas—million cubic feet	789,662	86,073	804,612	92,530
Natural gas liquids:				
LP gases—thousand gallons	656,751	24,154	661,330	20,359
Natural gasoline and cycle products—do	301,404	18,619	273,969	16,775
Perlite—short tons	245,654	2,159	258,164	2,143
Petroleum (crude)—thousand 42-gallon barrels	112,553	322,142	[5] 108,708	[5] 313,133
Potassium salts—thousand short tons, K_2O equivalent	2,523	96,380	2,208	85,124
Pumice—thousand short tons	339	879	308	741
Salt—do	33	284	43	334
Sand and gravel—do	12,523	10,049	6,889	8,021
Silver (recoverable content of ores, etc.) thousand troy ounces	283	261	302	327
Stone—thousand short tons	1,853	2,206	2,004	2,782
Uranium ore—short tons	3,631,036	62,482	3,478,238	63,504
Zinc (recoverable content of ores, etc.)—do	22,900	5,267	22,015	5,063
Value of items that cannot be disclosed: Cement, magnesium compounds (1961), manganiferous ore, sheet mica (1962), molybdenum, vanadium, and values indicated by footnote 4		[6] [7] 7,213		6,743
Total		[6] 690,913		674,064

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay; included with "Value of items that cannot be disclosed."
[3] Weight not recorded.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Preliminary figure.
[6] Revised figure.
[7] Value of metals, $896,000; value of nonmetals, $6,317,000

[1] Mining engineer, Bureau of Mines, Socorro, N. Mex.

was reported from all except 1 (Los Alamos) of the 32 counties. Five counties in which the value of the mineral production was more than $50 million, in order of rank, were Lea, Eddy, San Juan, Grant, and McKinley. The five principal mineral commodities produced in order of value were petroleum, natural gas, potassium salts, uranium ore, and copper. The State was the Nation's leading producer of perlite, potassium salts, and uranium ore.

The value of the output of each of the commodities—liquid petroleum, natural gasoline, and petroleum products in the fuels group; barite, cement, clays, gem stones, magnesium compounds, perlite, potassium salts, pumice, and sand and gravel in the nonmetals group; and lead and zinc in the metals group—was lower than that of 1961.

Employment and Injuries.—Final data for 1961 and preliminary data for 1962 compiled by the Bureau of Mines for employment and injuries in the New Mexico mineral industries, excluding all mineral fuels except coal, are shown in table 2.

TABLE 2.—Employment and injuries in the mineral industries[1 2]

Industry	Number of operations[3]	Average number of men employed	Total man-hours worked	Injuries		Frequency rate (injuries per million man-hours)
				Fatal	Nonfatal	
1961:						
Nonferrous mines, mills, and smelter	102	1,705	4,118,255	2	191	46.9
Metal mines and mills (other)	4	75	154,736		14	90.5
Uranium mines and mills	60	3,175	7,423,296	4	245	33.5
Potash mines and mills	15	2,638	6,802,624	5	210	31.6
Nonmetal mines and mills (other)	63	272	452,093		19	42.0
Stone quarries and plants	52	236	476,226		5	10.5
Sand and gravel plants	103	1,165	1,685,629		32	19.0
Coal mines	23	238	358,411	1	17	50.2
Total	422	9,504	21,471,270	12	733	34.7
1962:[4]						
Nonferrous mines, mills, and smelter	57	1,662	3,861,941	1	189	49.2
Metal mines and mills (other)	9	95	177,559	1	13	78.8
Uranium mines and mills	53	2,815	6,753,112	7	157	24.3
Potash mines and mills	13	2,148	5,216,520	3	181	35.3
Nonmetal mines and mills (other)	50	211	358,505		11	30.7
Stone quarries and plants	57	238	470,639		5	10.6
Sand and gravel plants	109	475	790,649		12	15.2
Coal mines	21	317	340,770	2	11	38.1
Total	369	7,961	17,969,695	14	579	33.0

[1] Excludes employees in all mineral fuels industries except the coal industry.
[2] Excludes office figures.
[3] Each mine and mill counted.
[4] Preliminary figures.

Legislation and Government Programs.—An Office of Minerals Exploration (OME) contract was executed in 1962 between the Government and Henry Clay Mines, Inc., for exploration work for gold-silver-copper mineralization in Hidalgo County.

The Federal Government domestic mica and beryl purchasing programs, started in 1952, were terminated in June.

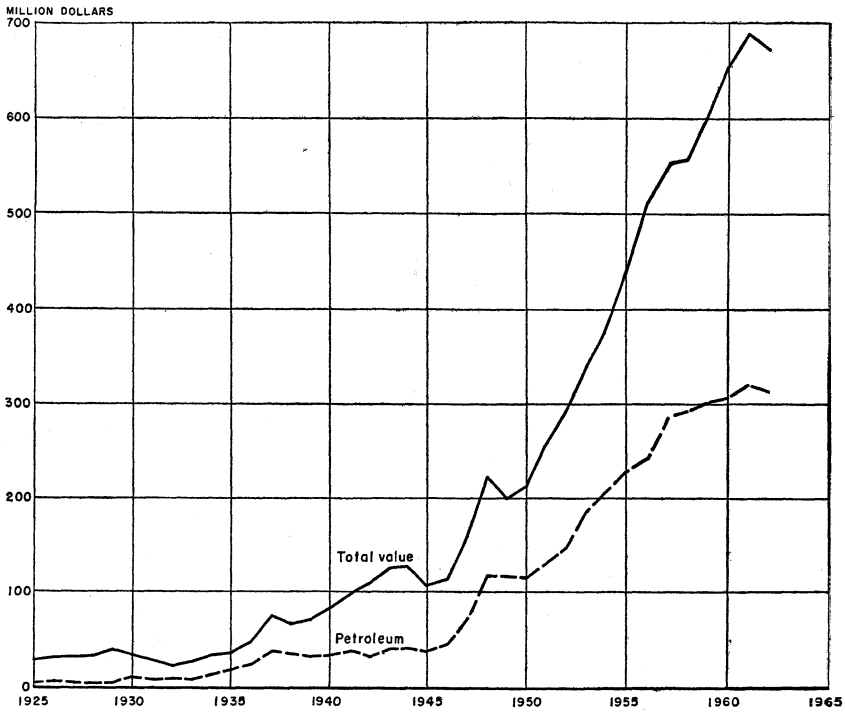

FIGURE 1.—Value of petroleum production and total value of all minerals produced in New Mexico, 1925–62.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The total value of output of the mineral fuels (carbon dioxide, coal, helium, natural gas, natural gas liquids, and petroleum) was 2 percent less than in 1961, but constituted 66 percent of the total value of all mineral production in the State.

Carbon Black.—Natural gas was processed in carbon black plants of Columbian Carbon Co., Continental Carbon Co., and United Carbon Co., all in southeast New Mexico. Output of carbon black was 33 percent less than in 1961; the gas used was 34 percent less. The Columbian Carbon Co. plant was shut down October 16.

Carbon Dioxide.—Production of carbon dioxide gas from wells in Harding County increased threefold over that of 1961. The gas was processed and marketed as dry ice and liquid carbon dioxide, mainly for refrigerating fruit and vegetable trucks. Carbon dioxide also was used as a coolant at Sandia Base and Hollamon Air Force Base for liquid oxygen and other gases and equipment used in experimental work and in missile firing and research.

Coal (Bituminous).—Production of coal increased by 64 percent (265,000 tons), compared with that of 1961, primarily because of the

output of The Pittsburg & Midway Coal Mining Co. strip mine in western McKinley County. An 8-mile railroad spurline to this property completed late in 1961 provided a market outlet for the coal. In all, 14 mines in 5 counties—4 in Colfax, 5 in McKinley, 3 in Rio Arriba, and 1 each in Sandoval and San Juan—produced coal.

Helium.—The quantity of helium recovered at the Bureau of Mines helium plant at Shiprock was 35 percent (14.8 million cubic feet) less than in 1961. A higher price for helium accounted for a 26-percent increase ($196,000) in the value of helium produced. Late in 1962, the completion of an 11-mile-long, 4-inch-diameter pipeline, constructed by Continental Oil Co., to furnish gas to the helium plant was announced. Gas containing about 5.5 percent helium and 80 percent nitrogen was delivered to the plant at the rate of 2.5 million cubic feet of gas per day from two wells in Table Mesa field.[2]

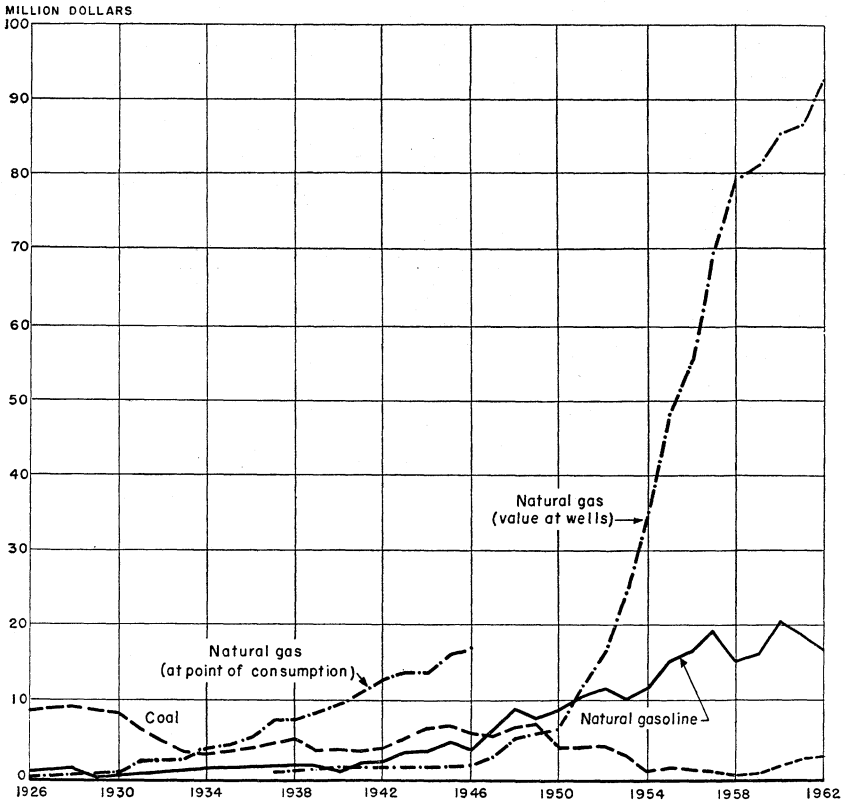

FIGURE 2.—Value of natural gas, natural gasoline, and coal in New Mexico, 1926–62.

[2] Oil and Gas Journal. V. 60, No. 49, Dec. 3, 1962, p. 104.

TABLE 3.—Coal (bituminous) production, by counties

(Excludes mines producing less than 1,000 short tons)

County	1961		1962	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Colfax	367,117	$6.04	256,648	$5.11
McKinley	35,083	5.73	410,099	2.97
Rio Arriba	4,552	5.96	5,507	6.53
Sandoval	2,314	6.50	1,245	6.28
San Juan	3,075	5.00	3,658	5.60
Total	412,141	6.01	677,157	3.83

[1] Value received or charged f.o.b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if the coal had been sold commercially.)

Natural Gas.—Marketed natural gas increased 2 percent in quantity and 8 percent in value, compared with that of 1961. The average value of gas at the wellhead increased from 10.9 cents per thousand cubic feet in 1961 to 11.5 cents. The annual report of the New Mexico Oil & Gas Engineering Committee for 1962 showed a total production of 786,753 million cubic feet from 6,967 wells. Of the total output, 60 percent was from the 1,359 wells in the southwestern counties. The report also showed that 711,250 million cubic feet of gas, or 90 percent of the total production, was treated at natural gas processing plants. Residual gas was marketed through pipelines (592.7 million cubic feet), used for fuel at processing plants (42.2 million cubic feet), returned to leases for fuel (5.7 million cubic feet), used for repressuring oilfields (4.1 million cubic feet), and flared (6.4 million cubic feet).

TABLE 4.—Production of natural gas, by counties

(Million cubic feet)

County	1961			1962		
	Dry gas	Oil well gas	Total	Dry gas	Oil well gas	Total
Chaves	437	1,536	1,973	484	1,508	1,992
Eddy	13,332	19,057	32,389	11,918	21,396	33,314
Lea	143,934	243,183	387,117	157,551	241,758	399,309
Rio Arriba	56,500	6,230	62,730	49,678	7,385	57,063
Roosevelt	23	5,597	5,620	63	11,270	11,333
Sandoval		8	8		3	3
San Juan	263,041	33,717	296,758	255,231	28,507	283,739
Total	477,267	309,328	786,595	474,925	311,827	786,753

Source: New Mexico Oil & Gas Engineering Committee. Annual Report 1961. V. 1-2, 1961, p. 2; Annual Report 1962. V. 1-2, 1962, p. 2.

Natural Gas Liquids.—New Mexico was ranked fifth in the Nation in production of natural gas liquids. Proved recoverable reserves were estimated at 517 million barrels, an increase of 15.9 million barrels for the year.[3] The number of processing plants increased from 35

[3] Oil and Gas Journal. V. 61, No. 13, Apr. 1, 1963, p. 73.

to 37.[4] Throughput of 711.2 billion cubic feet of gas yielded natural gasoline (11.4 million barrels), butane (8.3 million barrels), and propane (6.5 million barrels). A total of 42.2 billion cubic feet of residual gas was used for plant fuel, 5.7 billion for lease fuel, 10.2 billion for manufacturing carbon black, and 4.1 billion for repressuring. In addition, 592.7 billion cubic feet was returned to pipelines.[5]

TABLE 5.—Production of natural gas liquids, by counties

(Thousand gallons)

County[1]	Natural gas and cycle products		Liquid petroleum gases	
	1961	1962	1961	1962
Eddy	42,566	39,512	23,677	25,559
Lea	317,751	324,654	322,621	317,734
Rio Arriba	3,420	3,419	16,114	17,104
Roosevelt	8,436	4,625	14,744	12,698
San Juan	106,741	105,321	243,803	249,770
Total	478,914	477,531	620,959	622,865

[1] Production shown for county in which plant(s) are located.

Source: New Mexico Oil & Gas Engineering Committee. Annual Report. 1961: V. 1, pp. 336-340; v. 2, p. 98; Annual Report 1962: V. 1, pp. 336-340; v. 2, p. 102.

Petroleum.—Petroleum was recovered in eight counties, Chaves, Eddy, Lea, and Roosevelt in the southeastern part of the State; and in McKinley, Rio Arriba, Sandoval, and San Juan in the northwestern part of the State.[6] The southeastern part was the most productive area, producing 97.2 million barrels from 14,329 oil wells and 1.3 million barrels of distillate from 1,359 gas wells.[7] The output placed New Mexico sixth among the Nation's oil-producing States.[8] The increase in petroleum production, compared with that of 1961, came from additional productive wells; the average allowables were

TABLE 6.—Crude petroleum production, by counties

(Thousand barrels)

County	1961	1962	Principal fields (those producing more than 1 million barrels) in 1962 in order of production
Chaves	4,519	4,585	Caprock.
Eddy	[1] 14,341	14,996	Empire Abo, Loco Hills, Grayburg Jackson.
Lea	74,093	74,255	Vacuum, Denton, Gladiola, Hobbs, Maljamar, Langlie, Eumont, Eunice, Drinkard, Kemnitz, Saunders, Jalmat, Crossroads, Lovington, Caprock East, Pearl Queen.
McKinley	[1] 130	157	
Rio Arriba	1,276	1,189	
Roosevelt	3,864	4,650	Allison.
Sandoval	23	15	
San Juan	14,307	9,481	Bisti, Horseshoe, Cha Cha.
Total	[1] 112,553	109,328	

[1] Revised figure.

Source: New Mexico Oil & Gas Engineering Committee. Annual Report 1962. V. 1-2, 1962, 452 pp.

[4] Oil and Gas Journal. V. 61, No. 12, Mar. 25, 1963, p. 120.
[5] New Mexico Oil & Gas Engineering Committee. Annual Report 1962. V. 1, p. 340; v. 2, p. 102.
[6] Volume 1, page 2, and volume 2, page 2 of work cited in footnote 5.
[7] Volume 1, page 2 of work cited in footnote 5.
[8] Oil and Gas Journal. Volume 61, No. 4, Jan. 28, 1963, p. 170.

approximately the same for both years. Exploration and development drilling, 8.6 million feet, was 8.5 percent less than in 1961. The number of wells drilled totaled 1,666, a decline of 150 for the year.[9] The proved crude oil reserve of the State decreased 25.6 million barrels.[10]

TABLE 7.—Wildcat- and development-well completions in 1962, by districts and counties

District and county	Crude	Condensate	Gas	Dry	Service	Total	Footage
West New Mexico:							
Wildcat:							
Dona Ana				1		1	7,400
Luna				1		1	13,200
McKinley	1			13		14	11,100
Rio Arriba	2			11		13	25,300
Sandoval	1			12		13	33,000
San Juan	1		1	37		39	110,600
Total	5		1	75		81	200,600
Development:							
McKinley	6			3	7	16	7,900
Rio Arriba	41	1	161	16		219	1,159,200
Sandoval	3		1	6		10	16,200
San Juan	62		233	29		324	1,689,400
Total	112	1	395	54	7	569	2,872,700
East New Mexico:							
Wildcat:							
Chaves	2			19		21	72,200
Colfax				3		3	10,600
Eddy	2	1	2	51		56	201,600
Lea	27		4	86		117	860,700
Lincoln				1		1	3,400
Mora				1		1	1,100
Otero				3		3	6,700
Roosevelt	2			8		10	82,300
Torrance				1		1	4,100
Union				1		1	1,000
Total	33	1	6	174		214	1,243,700
Development:							
Chaves	10			10		20	59,300
Eddy	208		3	57	15	283	906,500
Lea	353		14	77	2	446	2,949,000
Roosevelt	46			6	1	53	362,100
Total	617		17	150	18	802	4,276,900
Total all drilling	767	2	419	453	25	1,666	8,593,900

Source: The Oil and Gas Journal.

METALS

Beryllium.—The Harding mine in Taos County produced and shipped beryllium-bearing ore to the General Services Administration (GSA) until the Government purchase program was terminated in June.

Copper.—The quantity and value of copper production increased 4 percent (3,077 tons) and 7 percent ($3.2 million) above those of 1961. Copper was produced and sold from 36 mining and precipitating operations in 7 counties; about 99 percent was from 3 mining opera-

[9] Page 210 of work cited in footnote 8.
[10] Page 72 of work cited in footnote 3.

tions—Chino and Bayard (Continental) in Grant County, and Bonney-Miser's Chest in Hidalgo County.

Gold.—Sixteen operators in five counties recovered gold from ore and dump rock. State output was 7,529 ounces, an increase of 1,328 ounces, compared with that of 1961. Mines in Grant and Hidalgo Counties produced more than 99 percent of total output. Leading producers were the Kennecott Copper Corp. Chino mine and the Banner Mining Co. Bonney-Miser's Chest mine.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1953-57 (average)	55	3	7,818	2,911	$102	254	$229
1958	20	----	5,873	3,378	118	159	144
1959	30	----	4,686	3,155	110	159	144
1960	33	----	7,804	5,423	190	304	275
1961	39	1	7,751	6,201	217	283	261
1962	22	----	7,687	7,529	264	302	327
1848-1962	[3]	[3]	[3]	2,243,209	51,847	72,925	57,683

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953-57 (average)	68,254	$46,138	3,692	$1,082	19,269	$4,802	$52,353
1958	55,540	29,214	1,117	261	9,034	1,843	31,580
1959	39,688	24,369	829	191	4,636	1,066	25,880
1960	67,288	43,199	1,996	467	13,770	3,553	47,684
1961	79,606	47,764	2,332	480	22,900	5,267	53,989
1962	82,683	50,933	1,134	209	22,015	5,063	56,796
1848-1962	2,422,523	1,004,141	336,416	47,024	1,254,249	237,587	1,398,282

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old tailings, old slag, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Data not available.

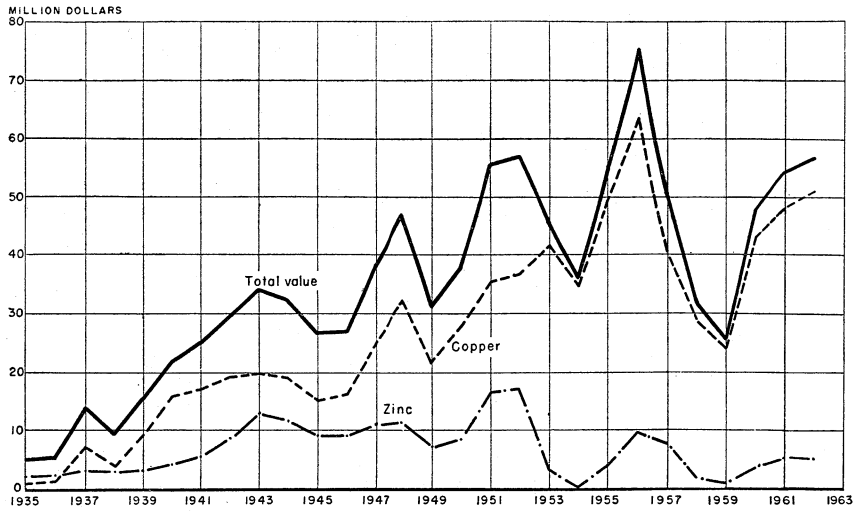

FIGURE 3.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1935–62. The value of gold, silver, and lead produced annually has been relatively small.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1962, by counties, in terms of recoverable metals

County	Mines producing (lode)	Lode material sold or treated [1] (short tons)	Gold		Silver		Copper		Lead		Zinc		Total value
			Troy ounces	Value	Troy ounces	Value	Short tons	Value	Short tons	Value	Short tons	Value	
Dona Ana	1						1	$185					$185
Grant	10	7,539,492	4,956	$173,460	176,752	$191,776	80,128	49,358,940	1,042	$191,737	22,001	$5,060,253	54,976,166
Hidalgo	4	143,489	2,541	88,935	119,113	129,238	2,538	1,563,685	56	10,323	11	2,576	1,794,757
Lincoln	1	236	4	140	4,686	5,084	(4)	62	2	451	2	506	6,243
Luna	1	48			374	406			3	589	(4)	11	1,006
Otero	1	1,181			143	155	15	9,425	1	110			9,690
Sierra	1	5	16	560	159	173	(4)	185					918
Socorro	3	2.894	12	420	322	349	1	246	30	5,446	1	104	6,565
Total:													
1962	22	7,687,345	7,529	263,515	301,549	327,181	82,683	50,932,728	1,134	208,656	22,015	5,063,450	56,795,530
1961	[2] 40	7,750,637	[3] 6,201	[3] 217,035	[3] 282,755	[3] 261,404	79,606	47,763,600	2,332	480,392	22,900	5,267,000	53,989,431

[1] Does not include tonnage of precipitates shipped or gravel washed.
[2] All lode mines, except for 1 placer mine in Santa Fe County.
[3] Includes placer production and value: Gold—27 ounces, $945; silver—1 ounce, $1.
[4] Less than 0.5 ton.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold and dry gold-silver [2]	3	46,929	1,318	62,943	921,100	63,200	
Dry silver	3	1,423	4	4,848	30,900	6,100	4,400
Total	6	48,352	1,322	67,791	952,000	69,300	4,400
Copper	6	7,323,561	6,084	125,076	107,821,000		41,600
Lead	2	132	4	519	100	24,300	100
Lead-zinc	1	1,300	18	213	1,000	49,000	13,300
Zinc	3	311,200	96	107,774	409,200	2,084,100	43,969,700
Total	12	7,636,193	6,202	233,582	108,231,300	2,157,400	44,024,700
Other "lode" material:							
Copper precipitates	4	34,200			56,182,000		
Lead-barite tailings	1	2,800	5	176	700	41,300	900
Total	5	37,000	5	176	56,182,700	41,300	900
Total "lode" material	22	7,721,545	7,529	301,549	165,366,000	2,268,000	44,030,000

[1] Detail will not necessarily add to totals because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1962, by types of material processed and methods of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation: Ore	3	1			
Concentration and smelting of concentrates: [1] Ore	6,188	233,930	107,961,500	2,180,800	44,025,500
Direct-smelting:					
Ore	1,338	67,618	1,099,000	87,200	4,500
Copper precipitates			56,182,000		
Total	1,338	67,618	57,281,000	87,200	4,500
Leaching of copper ore			123,500		
Grand total	7,529	301,549	165,366,000	2,268,000	44,030,000

[1] Includes lead-barite tailing concentrate.

Iron Ore.—Output of magnetite ore from mines in Grant and Socorro Counties totaled 9,199 long tons valued at $121,000. Most of the ore was concentrated before shipment; only a small tonnage was direct-shipping ore. On a wet basis, the direct-shipping ore averaged 63 percent iron and 4.7 percent moisture, and iron concentrate averaged 62 percent iron and 2.0 percent moisture. The ore was used in cement and high-density concrete.

Lead.—Output of lead was 1,198 tons (51 percent) below that of 1961. The production decline was caused primarily by the closing of the Linchburg mine in Socorro County in November 1961. Although lead was recovered from ores produced by 14 operations in

6 counties, 1,042 tons (92 percent) of the State total production was derived from zinc ores produced at 3 Grant County mines. The Kearney mine, near Hanover, operated by American-Peru Mining Co., was the largest producer. The Hanover and Oswaldo mines, both operated by The New Jersey Zinc Co. until December 1, were second and third, respectively. The remaining production came from gold-silver, lead, lead-zinc, and silver ores mined in Hidalgo, Lincoln, Luna, Otero, and Socorro Counties, and from lead-barite tailing in Socorro County.

Manganese Ore and Concentrate.—A small tonnage of stockpiled manganese concentrate was shipped from Socorro County to El Paso, Tex., where it was processed for use in commercial fertilizers and as a reagent in uranium-ore refining mills.

Ferruginous manganese ore, containing less than 35 percent manganese, was mined by Luck Mining Co. from the Boston Hill mine in Grant County. The ore was shipped to The Colorado Fuel and Iron Corp. (CF&I) steel plant at Pueblo, Colo.

Molybdenum.—The entire output of molybdenum came from molybdenum concentrate produced by Kennecott Copper Corp. in the Chino concentrator at Hurley, Grant County. The molybdenum concentrate was recovered as a byproduct of the treatment of molybdenum-bearing copper concentrate produced from Chino copper ore. For the seventh year, Molybdenum Corporation of America continued an exploration and development program, partly financed by a Defense Minerals Exploration Administration (DMEA) contract, at the Questa mine in Taos County. The corporation annual report noted that beginning in October, all underground exploration work was concentrated in the northeast part of the property previously explored. Results of assays of sampling in drifts and raises in the area confirmed the accuracy of sludge assays secured from the drilling program.

Silver.—The quantity and value of silver produced were 7 percent percent (19,000 ounces) and 25 percent ($66,000) greater, respectively, than in 1961. Leading silver-producing mines in descending order of production were Chino, Grant County; Bonney-Miser's Chest, Hidalgo County; Hanover and Kearney, Grant County; and Henry Clay, Hidalgo County. Of the 79 percent of the State total silver output which came from these mines, 12 percent was from gold-silver ores, 47 percent from copper ores, and 41 percent from zinc ores.

Uranium Ore.—New Mexico was again the Nation's leading producer of uranium ore, which was mined at 69 operations in 5 counties—51 in McKinley, 8 in San Juan, 7 in Valencia, 2 in Socorro, and 1 in Santa Fe. Ore mined, 3.5 million tons, was 4 percent less (152,798 tons) than in 1961, principally because of a reduction in the Atomic Energy Commission (AEC) procurement program for uranium oxide. However, the total value of the uranium ore output ($63.5 million) and average weighted grade (0.23 percent U_3O_8) were higher.

United Nuclear Corp. acquired Sabre-Pinon Corp. in April. The Anaconda Company reduced mining and milling operations at Grants to conform with the terms of its contract with AEC according to the company annual report. Ore production at the Paguate mine began, and except for a small amount shipped for test purposes, the

ore was stockpiled near the mine. The ore requirements of the Bluewater plant were supplied primarily from stockpiles at the Jackpile mine. The company was negotiating with AEC to increase purchases of ore and extend deliveries of U_3O_8 concentrate through 1970. The Anaconda uranium-mill waste water was successfully disposed through deep well injection.[11]

Vanadium.—The value of vanadium output, all of which was produced as a byproduct of processing uranium ore mined in New Mexico and treated at plants in New Mexico and Colorado, was 224 times greater than that of 1961. Ores from some of the uranium mines in San Juan and McKinley Counties contained vanadium that was recovered.

Zinc.—The output of zinc declined 4 percent (885 short tons) below that of 1961. More than 99 percent of the zinc recovered from ore produced was mined in Grant County. Mining operations at the Hanover and Oswaldo mines and milling operations at the Hanover mill of The New Jersey Zinc Co. were closed December 1.

NONMETALS

Barite.—Early in January, Galbar, Inc., produced small quantities of barite and galena concentrates by processing selected mill tailing at the Mex-Tex mill at San Antonio in Socorro County. A few tons of barite, produced in connection with annual assessment work at the Elaine group, Socorro County, was crushed and sold for making radiation-dampening heavy concrete building blocks.

Cement.—Production of portland and masonry cements at the Ideal Cement Co. Tijeras plant east of Albuquerque was suspended between January 15 and March 26, resulting in a decline in cement production for the year.

Clays.—The tonnage of miscellaneous clay sold or used was less than in 1961. Principal uses were for cement, brick, and sewer and drain tile and in drilling muds. Production was from Bernalillo, Dona Ana, and McKinley Counties. Fire clay was produced in Hidalgo, Luna, and McKinley Counties.

Gem Stones.—The value of gem stones and mineral specimens collected in New Mexico was 2 percent less than in 1961. Luna County was the principal source of gem stones. Agate was the principal gem material collected, but amethyst, aragonite, chalcedony, quartz crystals, jasper, Mexican onyx, smithsonite, turquoise, and petrified wood also were collected.

Gypsum.—Forty-four percent (46,000 short tons) more gypsum was mined than in 1961. Large users included American Gypsum Co., Albuquerque wallboard plant; Kaiser Gypsum Co., Inc., Rosario plant; and Ideal Cement Co., Tijeras plant.

Lime.—The only producer of lime in New Mexico was Kennecott Copper Corp., Grant County, which produced and used 16 percent more than in 1961.

Magnesium Compounds.—There were no shipments of magnesium compounds.

[11] Mining Engineering. V. 14, No. 7, July 1962, pp. 49–52.

Mica.—The quantity and value of scrap mica production were 218 and 169 percent greater, respectively, than in 1961. Sheet mica from one property was sold to GSA before the Federal Government domestic-mica purchasing program was terminated in June. Scrap mica was produced from five deposits in the north-central part of the State. Important buyers of scrap mica were Los Compadres Mica Co., Ojo Caliente; and Mineral Industrial Commodities of America, Inc., (formerly Clute Corp.) Pojoaque. Mica was ground in mills operated by the two companies.

TABLE 12.—Mica sold or used by producers

Mica	1958	1959	1960	1961	1962
Hand-cobbed, total:[1] Pounds	97,780	14,828	81		
Sheet:[1]					
Full-trimmed:					
Pounds	176	59			(2)
Value	$2,654	$676			(2)
Average per pound	$15.08	$11.46			(2)
From hand-cobbed:					
Pounds	1,615	188	5		
Value	$15,743	$922	$4		
Average per pound	$9.75	$4.90	$0.80		
Total:					
Pounds	1,791	247	5		(2)
Value	$18,397	$1,598	$4		(2)
Average per pound	$10.27	$6.47	$0.80		(2)
Scrap:					
Short tons	787	210	235	1,800	5,731
Value	$24,466	$6,562	$6,780	$52,200	$139,620
Average per ton	$31.09	$31.25	$28.85	$29.00	$24.36
Total sheet and scrap:					
Short tons	788	210	235	1,800	(2)
Value	$42,863	$8,160	$6,784	$52,200	(2)

[1] Sold to the Government through GSA.
[2] Figure withheld to avoid disclosing individual company confidential data.

Perlite.—Although perlite production increased 5 percent (12,500 tons), the value of the output declined 1 percent ($16,000), compared with that of 1961. Major producers were Great Lakes Carbon Corp., Johns-Manville Perlite Corp., and United Perlite Corp.—all operating in the No Agua area of Taos County. United States Gypsum Co. continued to mine and mill perlite at Grants.

TABLE 13.—Crude perlite sold or used by producers

Year	Short tons	Value (thousands)
1958	202,046	$1,790
1959	240,642	2,121
1960	240,593	2,119
1961	245,654	2,159
1962	258,164	2,143

Potash.—Output of potash declined 12 percent in quantity and value compared with that of 1961. Most of the decrease was caused by a strike lasting 58 days, June 1 to July 28, at six potash-producing companies in the Carlsbad area. Five plants were idle during the period, and one continued operations. A milestone was reached on

April 18 when the millionth carload of potassium salts was shipped by rail from Carlsbad; the first commercial shipment was made in March 1931.

Potash Company of America completed a $5 million project wherein the potassium-salt milling facilities were converted to the amine-treatment process. International Minerals & Chemical Corp. (IMC) installed a $500,000 hot-processing unit to increase the efficiency of the potassium sulfate production unit and started work on a $1 million mill circuit to recover langbeinite from sylvite tails at the Carlsbad plant. Duval Sulphur & Potash Co. announced plans to spend $8 million for developing a sylvite-langbeinite deposit in the Carlsbad area. National Potash Co. announced plans to develop a $3 million second mine unit south of the Potash Company of America operation. In November, Kermac Potash Co. awarded a contract to Western-Knapp Engineering Co. for constructing a $20 million, 1,500-ton-per-day potassium-salt processing plant in the Carlsbad area to be in full production in 1964.

TABLE 14.—Potassium salts production and sales

(Thousand short tons)

Year	Crude salts,[1] mine production		Marketable potassium salts					
			Production			Sales		
	Gross weight	K_2O equivalent	Gross weight	K_2O equivalent	Value[2] (thousands)	Gross weight	K_2O equivalent	Value (thousands)
1958	12,224	2,309	3,355	1,978	$69,106	3,650	2,157	$75,343
1959	13,933	2,588	3,707	2,189	74,117	3,821	2,258	76,725
1960	15,071	2,841	4,138	2,440	82,645	4,092	2,412	81,653
1961	15,653	2,934	4,281	2,523	96,380	3,882	2,281	87,415
1962	14,115	2,619	3,758	2,208	85,124	4,206	2,476	95,851

[1] Sylvite and langbeinite.
[2] Derived from reported value of "Sold or used."

Pumice.—The tonnage and value of the total crude and processed scoria, volcanic cinders, and pumice sold or used in New Mexico decreased 9 percent and 16 percent, respectively, compared with the 1961 output. Scoria and volcanic cinders constituted 70 percent of the total tonnage and 42 percent of the value of the pumice output. Scoria and volcanic cinders were used principally as aggregate in manufacturing concrete blocks and roofing and as railroad ballast. Pumice was sawed and used as a decorative facing for fireplaces and exterior siding on houses and buildings. It was sold for use as an abrasive, a lightweight concrete aggregate, a poured insulating filling in walls, a water-filtration medium, a soil aerator in containers for potting nursery plants, and for manufacturing matches and paint.

Salt.—Output of salt increased 30 percent in tonnage and 18 percent in value, compared with that of 1961. Most production came from Eddy County and was recovered as a byproduct of refining potash salts in the vicinity of Carlsbad. Salt obtained by solar evaporation of brine was produced at Salt Lake, north of Quemado in Catron County. Markets for the product included stock ranchers, feed deal-

ers, water-softener sales and service establishments, and State and county highway departments.

Sand and Gravel.—Production of sand and gravel declined 45 percent (5.6 million tons), and the value of the output was 20 percent less ($2.0 million) than in 1961—primarily because of the completion of the Navajo Dam which had required a large quantity. Production was reported in all except one of the counties (Los Alamos). Bernalillo was the leading producing county.

A U.S. Department of Commerce report [12] stated that of a total of 1,006.9 miles designated as a part of the Interstate Highway System in New Mexico, 326.7 miles was open to traffic. Of this total, 231.2 miles was completed to full and acceptable standards, and 95.5 miles was improved to standards adequate for present traffic. Work in progress on December 31 included 82.8 miles under construction and 164.2 miles in the engineering and right-of-way planning stage. This program of highway construction absorbed much of the sand and gravel produced in the State.

TABLE 15.—Sand and gravel production in 1962, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Bernalillo	1,198	$1,379	Quay	589	$727
Catron	50	33	Rio Arriba	146	220
Chaves	405	367	Roosevelt	139	247
Colfax	380	714	Sandoval	105	188
Curry	34	22	San Juan	499	682
De Baca	66	92	San Miguel	100	102
Dona Ana	1,139	723	Santa Fe	176	380
Eddy	67	65	Sierra	43	44
Grant	60	68	Socorro	3	7
Harding	82	168	Taos	386	503
Hidalgo	414	252	Torrance	(1)	(1)
Lea	147	107	Union	(1)	(1)
Lincoln	19	35	Valencia	197	275
Luna	30	28	Undistributed	184	262
McKinley	62	117			
Mora	48	48	Total	6,889	8,021
Otero	121	166			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Contractors for the Federal Bureau of Public Roads, New Mexico State Highway Department, and county highway departments were awarded contracts totaling $45.8 million. The contracts consisted of $29.2 million for Interstate road construction, $15.8 million for the Federal-Aid Primary and Secondary (ABC) Highway System, and $880,000 for 100-percent State financed roads. These figures represented an increase of 6 percent over the total amount awarded in 1961. Planned for 1963 were $30 million in Interstate contracts, $15 million in ABC construction, and $3.5 million for 100-percent State financed highways.[13]

[12] Bureau of Public Roads. Quarterly Report on the Federal-Aid Highway Program, Dec. 31, 1962. Press release BPR 63-10, Feb. 10, 1963.
[13] Engineering News-Record. Road Contractors Will Set a Record. V. 170, No. 16, Apr. 18, 1963, pp. 21-24.

TABLE 16.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Construction sand:				
Building	796	$927	770	$854
Paving	153	211	383	461
Fill	34	55	59	59
Other	95	136	125	221
Industrial sand: Engine			1	3
Total	1,078	1,329	1,338	1,598
Construction gravel:				
Building	792	1,033	785	1,035
Paving	1,919	2,170	1,289	1,516
Railroad ballast	46	25	(1)	(1)
Fill	92	167	54	69
Other	4	8	23	37
Miscellaneous gravel	180	180	101	129
Total	3,033	3,583	2,252	2,786
Total sand and gravel	4,111	4,912	3,590	4,384
Government-and-contractor operations:				
Sand:				
Building	26	24	22	67
Paving	167	183	130	221
Other			1	3
Total	193	207	153	291
Gravel:				
Building	23	63	10	30
Paving	3,066	3,895	3,129	3,303
Fill	5,130	972		
Other			7	13
Total	8,219	4,930	3,146	3,346
Total sand and gravel	8,412	5,137	3,299	3,637
All operations:				
Sand	1,271	1,536	1,491	1,889
Gravel	11,252	8,513	5,398	6,132
Total	12,523	10,049	6,889	8,021

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

Stone.—The quantity and value of stone production increased 8 percent (151,000 tons) and 26 percent ($576,000), respectively, compared with those of 1961. Counties in which more than 100,000 tons was quarried, in descending order, were Bernalillo, Lea, Colfax, McKinley, Curry, Rio Arriba, and Eddy. Production of basalt and related rocks (traprock) increased 73-fold. Most of the basaltic rock was used by the New Mexico State Highway Department, in place of the sandstone used in 1961.

Sulfur.—Elemental sulfur was recovered from sour gases by the modified Claus process at the Empire Abo plant of North Texas-New Mexico Division of Pan American Petroleum Corp. and at the Artesia plant of Phillips Petroleum Co.

TABLE 17.—Stone production in 1962, by counties

County	Short tons	Value	County	Short tons	Value
Bernalillo	(1)	(1)	Luna	40	$1,400
Chaves	17,338	$44.733	McKinley	244,880	234,880
Colfax	279,084	390.586	Rio Arriba	155,925	157,500
Curry	219,286	320,496	Roosevelt	3,302	9,213
De Baca	50,000	71,000	San Miguel	5,884	82,777
Dona Ana	68	834	Torrance	5,024	7,425
Eddy	211,421	402,283	Valencia	(1)	(1)
Grant	75,117	56,904	Undistributed	386,681	608,351
Lea	338,075	378,724			
Lincoln	11,647	15,134	Total	2,003,772	2,782,240

1 Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 18.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1958	26,100	$24,500	9,075	$9,000	200	$2,500	795,077	$801,487
1959			1,000	5,200	37	732	224,501	298,648
1960	1,869	2,492	9,418	21,750			696,268	927,717
1961			2,025	2,025	80	11,029	1,164,575	1,516,250
1962			148,858	201,758	(1)	(1)	918,483	1,298,410

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1958	900,033	$669,790			1,730,485	$1,507,277
1959	175,315	179,996	60,362	$57,376	461,215	541,952
1960	64	1,105	569,001	739,312	1,276,620	1,692,376
1961	115,331	87,587	571,098	588,775	1,853,109	2,205,666
1962	95	1,125	936,336	1,280,947	2,003,772	2,782,240

1 Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

REVIEW BY COUNTIES

Mineral production was reported in all except 1 (Los Alamos) of the 32 counties. Only those counties with significant mineral production or in which the production of cited minerals materially changed in 1962 are discussed; see table 19 for additional details.

Bernalillo.—The value of the mineral production in Bernalillo County was 3 percent lower than in 1961. Except for that of stone, the value of output of all commodities decreased.

Catron.—Primarily because sand and gravel production was below that of 1961, the value of mineral production for the county was only one-third that reported for 1961. Salt was produced at the solar-evaporation facilities of Rock Mountain Salt Co., northwest of Quemado. Lease holders began timbering and cleanup operations before opening the Bearup gold-silver mine, which was reached by traveling up Mineral Creek, near Mogollon.

Chaves.—The number of producing petroleum wells increased from 730 in 1961 to 757 in 1962, and output of petroleum increased from

4.5 to 4.6 million barrels. Three gas wells produced throughout 1962. Outputs of sand and gravel and stone were less than in 1961.

TABLE 19.—Value of mineral production in New Mexico, by counties[1]

County	1961	1962[2]	Minerals produced in 1962 in order of value
Bernalillo	$7,697,669	$7,489,578	Cement, sand and gravel, stone, clays, gypsum, pumice.
Catron	162,787	54,276	Sand and gravel, salt, gem stones.
Chaves	[3] 14,011,100	13,771,153	Petroleum, sand and gravel, natural gas, stone, gem stones.
Colfax	2,451,454	2,416,820	Coal, sand and gravel, stone.
Curry	78,696	342,796	Stone, sand and gravel.
De Baca	(4)	163,100	Sand and gravel, stone.
Dona Ana	588,906	821,669	Sand and gravel, pumice, clays, stone, gem stones, copper.
Eddy	[3] 138,554,799	128,748,921	Potassium salts, petroleum, natural gas, natural gasoline, LP gases, stone, salt, sand and gravel, gem stones.
Grant	53,145,146	56,651,818	Copper, zinc, molybdenum, lime, manganiferous ore, silver, lead, gold, sand and gravel, stone, gem stones, iron ore.
Guadalupe	152,700	----------	
Harding	54,890	242,253	Sand and gravel, carbon dioxide (natural).
Hidalgo	1,927,238	2,064,713	Copper, sand and gravel, silver, gold, clays, lead, zinc, gem stones.
Lea	[3] 290,028,936	289,499,104	Petroleum, natural gas, natural gasoline, LP gases, potassium salts, stone, sand and gravel.
Lincoln	378,902	59,917	Sand and gravel, stone, silver, pumice, zinc, lead, gold, copper, gem stones.
Luna	68,921	52,141	Sand and gravel, gem stones, clays, stone, lead, silver, zinc.
McKinley	50,150,295	54,284,510	Uranium ore, coal, petroleum, stone, vanadium, sand and gravel, clays.
Mora	80,301	47,600	Sand and gravel.
Otero	322,834	176,090	Sand and gravel, copper, silver, lead.
Quay	748,600	727,300	Sand and gravel.
Rio Arriba	[3] 12,406,396	11,161,621	Natural gas, petroleum, LP gases, sand and gravel, stone, pumice, natural gasoline, coal, mica (scrap), mica (sheet), gem stones.
Roosevelt	[3] 12,851,392	15,440,713	Petroleum, natural gas, LP gases, sand and gravel, natural gasoline, stone.
Sandoval	[3] 348,655	525,343	Gypsum, sand and gravel, petroleum, pumice, coal.
San Juan	[3] 89,170,630	73,070,043	Natural gas, petroleum, LP gases, natural gasoline, helium, sand and gravel, uranium ore, vanadium, coal.
San Miguel	23,541	184,277	Sand and gravel, stone.
Santa Fe	980,000	926,173	Sand and gravel, pumice, gypsum, uranium ore.
Sierra	112,578	45,774	Sand and gravel, gem stones, gold, copper, silver.
Socorro	999,388	157,380	Iron ore, manganese concentrate, sand and gravel, lead, barite, uranium ore, perlite, gold, silver, copper, zinc, gem stones.
Taos	2,138,006	2,271,607	Perlite, sand and gravel, beryllium concentrate.
Torrance	74,760	(4)	Sand and gravel, stone.
Union	462,359	292,232	Pumice, sand and gravel.
Valencia	(4)	(4)	Uranium ore, perlite, sand and gravel, stone, gem stones, pumice.
Undistributed[5]	[3] 14,326,244	15,428,098	
Total[6]	[3] 690,913,000	674,064,000	

[1] Los Alamos is not listed because no production was reported.
[2] Petroleum value is preliminary.
[3] Revised figure.
[4] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[5] Includes some scrap mica (1962) and gem stones that cannot be assigned to specific counties and values indicated by footnote 4.
[6] Total adjusted to eliminate duplicating value of marketed potassium compounds.

Colfax.—The value of mineral production declined in Colfax County in 1962. Although the value of coal produced declined 41 percent, the values of sand and gravel and stone increased more than 300 and 500 percent, respectively.

Dona Ana.—The value of sand and gravel produced in Dona Ana County was about twice that in 1961 and constituted 88 percent of the value of the total mineral production in the county. Most of the

output was used by contractors working for the Federal Government and the New Mexico State Highway Commission. Pumice—lava stone, pumice, scoria, and volcanic cinders—and clay quarries also furnished significant tonnages.

Eddy.—The county was ranked first in the State in value of potassium salts mined and second in the total value of mineral production. According to the 1962 annual report of the New Mexico Oil & Gas Engineering Committee, petroleum was produced from 3,798 wells, 196 more than in 1961, and the petroleum production of 15 million barrels represented a 5-percent increase for the year. The number of producing gas wells increased from 62 to 65. Four percent of the natural gas produced in New Mexico came from wells in Eddy County.

Grant.—The largest mineral industries in Grant County were those mining and processing ores containing copper, zinc, lead, silver, and gold. As in previous years, much of the copper, all of the molybdenum, and part of the gold and silver came from ore mined by Chino Mines Division, Kennecott Copper Corp., at the Chino open-pit copper mine at Santa Rita. Kennecott Copper Corp. annual report disclosed that 7.1 million tons of ore, approximately the same as in 1961, was mined and milled at the Chino operation. The average grade of the ore milled, 18.2 pounds of copper per ton, was higher than that of ore handled in 1961, which had an average grade of 17.7 pounds per ton. Precipitating-plant production increased 30 percent, totaling 28,663 tons of copper, compared with 22,000 tons in 1961. Completion of the replacement of the molybdenite plant in the latter part of 1962, at a cost of more than $1 million, was expected to increase the recovery of that mineral in 1963. A $2.25 million skip ore-haulage system was placed in operation in January. The system increased efficiency in handling waste and ore from benches in the bottom of the open pit and in development of lower mining levels.

Some of the properties of the United States Smelting Refining and Mining Co. were operated by lessees: L. A. Patten & Associates operated the Bayard (Continental) mine, the county's third largest producer of copper in 1962; Douglas B. White operated the Zuniga mine; and Howard A. Wilmeth operated the Emma mine. Each of the operators leached oxidized copper ores.

Copper precipitates also were sold by 15 operators who recovered copper from the water of Santa Rita Creek below the Chino open-pit copper mine.

The New Jersey Zinc Co. Hanover mine and American-Peru Mining Co. Kearney mine were the principal zinc producers in New Mexico. The New Jersey Zinc Co. Hanover mine and mill were closed December 1. Rehabilitation work was continued in the Kennecott Copper Corp. Oswaldo mine, leased by The New Jersey Zinc Co. Operations were suspended at the American-Peru Mining Co. Pewabic mine following the collapse of the shaft headframe in mid-1961.

Hidalgo.—The value of copper constituted 87 percent of the total value of the metals produced in Hidalgo County. As in previous years, Banner Mining Co., operator of the Bonney-Miser's Chest mine, was the principal copper producer. The Banner Mining Co. annual report stated the production of 95,270 tons of ore, an increase of 6,272

tons compared with the 1961 output. The metal content of the 7,864 tons of concentrate produced from ores milled in 1962 was 1,208 ounces of gold, 55,952 ounces of silver, and 4,285,135 pounds of copper. Exploration and deveolpment work consisted of 3,167 feet of crosscutting and drifting, 1,943 feet of raising, 2,449 feet of diamond drilling, and 844 feet of longhole drilling.

High-silica lead and copper-bearing gold-silver ores were mined at the Henry Clay and Eighty-Five mines and loaded from the Eighty-Five dump in the Lordsburg district. The ore was shipped to the American Smelting and Refining Co. (Asarco) El Paso, Tex., smelter.

An OME contract was executed between the Government and Henry Clay Mines, Inc., for exploration in connection with a search for gold-silver-copper mineralization in Hidalgo County.

Lea.—About two-thirds of the petroleum and one-half of the natural gas produced in New Mexico in 1962 were obtained from wells in Lea County. Petroleum was produced from 9,607 wells, 434 more than in 1961. The number of producing gas wells increased from 1,249 in 1961 to 1,289.

Potassium-bearing salt was mined and refined by National Potash Co.

Lincoln.—Gold-copper-lead-zinc-bearing silver ore was mined and hand sorted by Silver Bar Mining Co. from the Bird mine, southwest of Capitan. The sorted material was gravity concentrated in a small mill, and the concentrates were shipped to the Asarco smelter at El Paso, Tex.

Luna.—Eddie Lindburg, the principal gem stone producer in Luna County, supplied the bulk of the gem stone production in New Mexico by open-pit mining of agate northwest of Columbus.

A white-clay deposit, primarily an altered lava flow, was opened on the east flank of the Little Florida Mountains. The clay was mined and used by Rio Brick Co., El Paso, Tex., as a stabilizing ingredient in producing uniformly colored clay products.

McKinley.—The county continued to head the list of uranium-producing counties in New Mexico. About 83 percent of the State uranium ore came from mines in the county.

The tonnage of coal mined increased almost 11-fold compared with the output in 1961. Shipments throughout 1962 from The Pittsburg & Midway Coal Mining Co. strip-pit mine in the western part of the county were a significant factor in the increased output.

Wells drilled for petroleum increased from 66 in 1961 to 75 in 1962. Of these, 60 were pumping wells, and 1 was a flowing well. Petroleum production increased 21 percent compared with that of 1961.

Rio Arriba.—Petroleum wells increased from 180 in 1961 to 228 in 1962, and gas wells from 1,219 to 1,317.

Three coal mines were operated in the county. The tonnage and value of the coal production increased 21 and 33 percent, respectively, compared with those of 1961.

Alaska International Corp. produced a few hundred tons of scrap mica from ore mined at its Joseph mine and processed in a mobile mica plant at the mine site. Midwestern Mining Co. produced and sold sheet mica to GSA from the Apache mine.

Roosevelt.—Producing petroleum wells increased from 114 in 1961 to 167; however, primarily because of proration applicable to wells brought in in 1961, petroleum output increased 20 percent over that of 1961. Quantity and value of gas produced were about twice those of 1961.

Washed and screened sand and gravel was produced by Sam Sanders from a pit 6 miles south of Portales. Removal of sand and gravel at the site led to a paleontological find of the remains and tusks of five mammoths and the remains of camels, horses, peccaries, and dire wolves.[14]

Sandoval.—Increases in the tonnage and value of gypsum and sand and gravel produced in Sandoval County in 1962 more than offset declines in the output of coal, pumice, petroleum, silver, copper, lead, and zinc. The value of mineral production was 51 percent greater than in 1961.

San Juan.—Eighty-seven percent of the petroleum and 83 percent of the natural gas produced in northwestern New Mexico in 1962 came from wells in San Juan County, according to information released in the annual report of the New Mexico Oil & Gas Engineering Committee, volumes 1 and 2, 1962. Petroleum production was from 1,451 wells, compared with 1,407 wells in 1961; but, because of proration, petroleum output declined about 34 percent. Gas production was 4 percent less, although the number of producing wells increased from 3,956 in 1961 to 4,291.

The tonnage of coal mined increased 19 percent over the output for 1961.

Santa Fe.—An increase was recorded in the tonnage of gypsum and pumice mined in the county. Gypsum mined by Kaiser Gypsum Co., Inc., was used in manufacturing wallboard at the company plant at Rosario. The output of pumice was 26 percent greater than in 1961.

Mineral Industrial Commodities of America, Inc., (formerly Clute Corp. at Pojoaque) purchased and processed sericite and muscovite mica for manufacturing paint.

Sierra.—The combined value of gold, silver, copper, lead, and zinc produced in Sierra County was only about one-ninth of that produced in 1961. Metal mining activity was confined to annual assessment work and sampling of mine dumps.

Socorro.—The value of gold, silver, copper, lead, and zinc ores mined in Socorro County declined to less than 1 percent of that in 1961. Early in 1962, a few tons of barite and galena were concentrated by Galbar, Inc., from selected mill tailings at the Mex-Tex mill at San Antonio. Barite was shipped from the Elaine group of claims, operated by A. B. Baca. Uranium ore was mined at two properties.

Taos.—The value of recorded mineral production increased 6 percent, compared with that of 1961. Perlite mining continued in the No Agua area in the northwest part of the county at open-pit mines operated by Great Lakes Carbon Corp., Johns-Manville Products Corp., and United Perlite Corp. The Los Compadres Mica Co. grinding mill at Ojo Caliente was operated by Vern Byrne. Hand-cobbed beryl was produced at the Harding mine, near Dixon.

[14] New Mexico Electric News, January 1963, p. 5.

Valencia.—The Anaconda Company discontinued mining operations at the Jackpile uranium ore mine but continued withdrawing ore from stockpiles. All mining activity was transferred to the nearby Paguate mine of the company.

A 51-percent controlling interest in All American Marble Co. was purchased by Charles Steen, Reno, Nev., in April. Travertine quarried from a deposit 30 miles southwest of Albuquerque was sawed and polished for decorative products in its plant at Albuquerque.

United States Gypsum Co. mined and crushed crude perlite for shipment to company-owned plants in various parts of the United States.

The Mineral Industry of New York

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the New York State Science Service for collecting information on all minerals except fuels.

By Stanley A. Feitler [1] and Madaline P. Stewart [2]

OUTPUT of the mineral industry increased $8.1 million to a total value of $241.9 million in 1962. The increase marked a partial recovery of the large drop in 1961. Greater demand by the construction and chemical industries was responsible for significant increases in the value of production for cement, salt, sand and gravel, and stone. The trend was mixed for other mineral commodities. New York continued to lead the Nation in production of talc and wollastonite and to be a major producer of cement, salt, sand and gravel, and stone.

TABLE 1.—Mineral production in New York [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays—thousand short tons	1,037	$1,373	1,397	$1,618
Emery—short tons	6,180	106	4,316	71
Gem stones	(2)	10	(2)	10
Gypsum—thousand short tons	663	3,441	601	3,122
Iron ore (usable)—thousand long tons, gross weight	1,973	25,548	2,099	24,953
Lead (recoverable content of ores, etc.)—short tons	879	181	1,063	196
Natural gas—million cubic feet	5,742	1,694	4,262	1,198
Peat—short tons	11,209	123	16,200	113
Petroleum (crude)—thousand 42-gallon barrels	1,658	7,892	[3] 1,789	[3] 8,229
Salt—thousand short tons	4,149	30,761	4,456	32 236
Sand and gravel—do	28,043	30,471	29,447	31,346
Silver (recoverable content of ores, etc.) thousand troy ounces	[4] 41	37	19	21
Stone—thousand short tons	26,951	43,734	27,589	47,256
Zinc (recoverable content of ores, etc.)—short tons	54,763	12,595	53,654	12,340
Value of items that cannot be disclosed: Abrasive garnet, beryl (1961), cement, lime, talc, titanium concentrate, and wollastonite		[4] 75,867		79,185
Total		[4] 233,833		241,892

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Preliminary figure.
[4] Revised figure.

[1] Mining engineer, Bureau of Mines, Pittsburgh, Pa.
[2] Statistical clerk, Bureau of Mines, Pittsburgh, Pa.

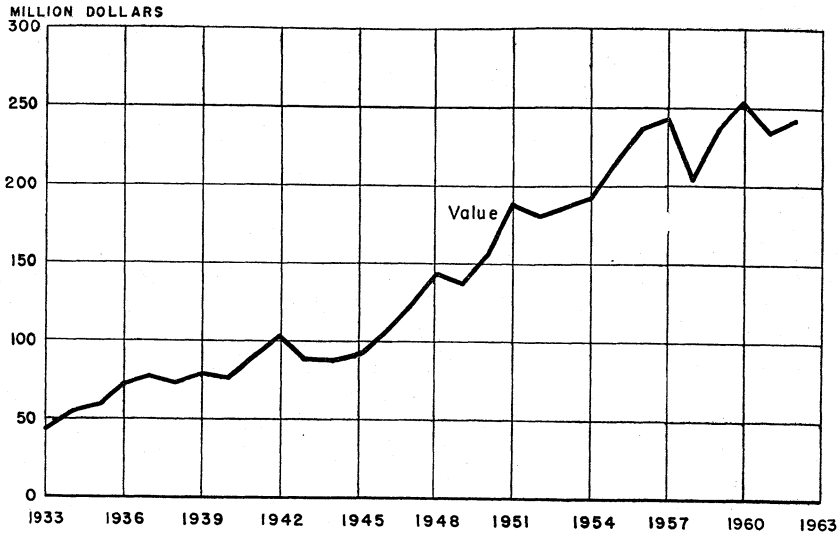

FIGURE 1.—Total value of mineral production in New York, 1933–62.

Employment and Injuries.—Many mineral producers entered the National Safety Competition sponsored annually by the Bureau of Mines. Although none of the participating New York operations was among the winners, many had outstanding safety records. New York mining operations that were awarded certificates for having no disabling work injury during the year included 2 in the nonmetal group, 14 in the quarry group, 3 sand and gravel plants, and 3 slag plants.

Trends and Developments.—Capacity for the production of construction materials was expanded greatly in the Hudson River Valley to take advantage of water transportation and proximity to the New York City market. The first cement was produced at Atlantic Cement Co. new 10-million-barrel-per-year plant at Ravena, Albany County. Atlantic Cement Co., Inc., program is based on sales to a broad market area through strategically located distribution centers, supplied by one efficient plant. Such distribution facilities have been completed, were under construction, or were planned to distribute Atlantic cement from New England to Florida. Production was started at the new fired clay lightweight aggregate plants of Hudson Lightweight Stone Div., Colonial Sand and Stone Co. and Nytralite Aggregate, Inc., both in Ulster County. Lightweight aggregate capacity in the Hudson River Valley had been expanded from about 125,000 tons per year in 1960 to about 750,000 by the end of 1962, including the expanded capacity installed by Northern Lightweight Aggregates, Inc., at its plant in Albany County. Another lightweight aggregate plant was under construction near Saugerties in Ulster County. Consolidated Edison Co. was building a plant in New York City to make lightweight aggregate from fly ash produced at the company power plants. Adequate supplies of lightweight aggregate for the New York market were assured by these developments.

Present and future electric power generating capacity were affected by completed construction and announced plans for more new generating plants. Mechanical modifications were completed and all generating units of the Robert Moses Niagara Power Plant were in operation during the last quarter of 1962. The 13 turbine generating units had a total rated capacity of 1,950,000 kilowatts. The adjacent Lewiston pump-storage generating plant, nearing completion, was designed to supply 240,000 kilowatts during periods of peak demand. Consolidated Edison Co. of New York announced plans to build a large pump-storage electric generating plant on the west bank of the Hudson River near Cornwall about 40 miles north of New York City. Excess steam-electric power generated during low-demand periods at other plants in the system will be used to pump Hudson River water to a storage reservoir situated at the crest of the Hudson Highlands for use in generating hydroelectric power during periods of peak demand. Consolidated Edison has also applied to the Atomic Energy Commission for permission to build a 1-million-kilowatt-nuclear-electric-power plant. The company, whose Indian Head nuclear power plant in Westchester County was in the final stages of construction, proposed to build the new plant in Queens County.

Exploration and mapping of the geology and mineral deposits of the State were continued during the year. Among the publications on mineral resources was an extensive report on the regional geology of the St. Lawrence County magnetite district.[3]

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Value of shipments increased 4 percent as cement continued to be the leading mineral commodity in the State. Shipments of portland cement increased 6 percent in quantity, and yearend stocks were almost 1 million barrels higher than in 1961. The average value of portland cement decreased from $3.39 per barrel in 1961 to $3.31 in 1962. Production and shipments of masonry cement were higher than in 1961, and the average value per barrel increased 4 cents to $2.60 in 1962. Production and shipments of natural cement also were higher than in 1961. Leading the State in value of cement shipments was Greene County, followed in decreasing order by Columbia, Ulster, Erie, Warren, Schoharie, Onondaga, and Albany Counties.

Raw material consumption by portland cement manufacturers, reflecting increased output of cement, was larger than in 1961. Portland cement manufacture consumed 2.9 million tons of limestone, 2.5 million tons of cement rock, 285,000 tons of clay and shale, and 141,000 tons of gypsum. Smaller quantities of iron-bearing materials, sand, bauxite, and fly ash also were consumed, as were minor quantities of air-entraining compounds, carbon black, and grinding aids. Portland cement was produced in types I–II (general use), type III (high-early-strength) and portland-slag in both regular and air-entrained classes.

[3] Buddington, Arthur F., and B. F. Leonard. Regional Geology of the St. Lawrence County Magnetite District, Northwest Adirondacks, New York. U.S. Geol. Survey, Prof. Paper 376, 1962.

Shipments to consumers were principally in bulk; two-thirds were by truck, one-quarter by railroad, and the rest by waterway. Cement in bags equivalent to 1.9 million barrels was shipped principally by truck and railroad. Although 63 percent of the portland cement produced in New York was consumed within the State, shipments were made to consumers in 12 other States, and a minor quantity was exported. New England States consumed 34 percent of the portland cement produced in New York. Distribution of portland cement shipments by type of customer was as follows: Ready-mixed concrete companies, 65 percent; highway and other contractors, 15 percent; manufacturers of concrete products, 10 percent; and building material dealers, 10 percent. Direct shipments to miscellaneous customers, and Federal, State and local government agencies were less than 1 percent.

Annual finished portland cement capacity was increased 40 percent to 34,956,000 barrels in October when the new plant of Atlantic Cement Co., Inc., was completed. At yearend wet-process plants accounted for 70 percent of the total capacity. Cement plants used 474 million kilowatt-hours of electrical energy; 94 percent was purchased from public utility companies, and 6 percent was generated by recovering heat from stack gases.

Alpha Portland Cement Co. announced plans to modernize and expand its Catskill cement plant. Plans provided for annual capacity of 3 million barrels, a 76 percent increase over present capacity. Marquette Cement Manufacturing Co. began operations at its distribution plant in Queens County. The 8-silo facility was supplied with cement produced at the company's Catskill plant and transported in a company-owned ship.

Clays.—Demand for clay products was good, but most of the 35-percent increase in output of clay and shale was attributable to operation of pits to supply two new lightweight aggregate plants which started operations during the year. The quantity of clay and shale used for the manufacture of lightweight aggregate was 127 percent greater than in 1961. New plants of Hudson Lightweight Stone Division, Colonial Sand & Stone Co., Inc., and Nytralite Aggregates, Inc., a subsidiary of New York Trap Rock Corp., began producing lightweight aggregate; both were located near Kingston in Ulster County. The newly installed second kiln of Northern Lightweight Aggregates, Inc., also was put into operation during 1962. Increased demand for building brick and other heavy clay products was responsibile for a 7-percent rise in clay used in this category. Clay used in manufacturing cement increased 5 percent. Albany slip clay mined in Albany and Rensselaer Counties was part of the ceramic mix used in bonded abrasive wheels and shapes. A small quantity of Albany slip clay was exported. The leading counties in decreasing order of tonnage of clay and shale produced were Ulster, Erie, Albany, Orange, and Onondaga.

Emery.—The entire U.S. production of emery continued to be recovered from three open pit mines in Westchester County. The emery was processed and used for general abrasive purposes and also as an aggregate for heavy-duty, nonslip floors.

Garnet (Abrasive).—Garnet was recovered from mines in Essex and Warren Counties. Garnet was mined in Warren County as a primary product and was ground and sized for use in manufacturing coated abrasives and as a polishing agent for glass and metal. In Essex County the garnet was recovered as a byproduct of wollastonite; limited quantities were sold for a variety of abrasive uses.

Gem Stones.—Quarries, mine dumps, and rock outcrops continued to attract gem and mineral collectors. Among the materials recovered were beryl, garnet, quartz, hematite, magnetite, and graphite. The garnet mines near North River in Warren County were popular with gem collectors and amateur lapidarists.

Graphite (Manufactured).—Great Lakes Carbon Corp. and National Carbon Co., Division of Union Carbide Corp., used petroleum coke to produce manufactured graphite at Niagara Falls. Products consisted of anodes, electrodes, other finished shapes, and blanks that were machined to specification by the user.

Gypsum.—Production of crude gypsum decreased 9 percent in quantity and value compared with that of 1961. Gypsum was recovered from five underground mines; three in Erie County and one each in Genesee and Monroe Counties. Crude gypsum (uncalcined) was used mainly as a retarder in portland cement. Output of calcined gypsum totaling 1.2 million tons valued at $17.4 million was slightly lower in quantity and higher in value than in 1961. The major use for calcined gypsum was in manufacturing wallboard and lath and in the formulation of various types of plaster; other uses were in manufacturing plate glass, pottery plasters, industrial molding, art, and casting plasters. New York continued to rank first in production of calcined gypsum.

TABLE 2.—Crude gypsum production

(Thousand short tons and thousand dollars)

Year	Active mines	Quantity	Value	Year	Active mines	Quantity	Value
1953-57 (average)	5	1,075	$4,097	1960	5	755	$3,928
1958	5	834	3,869	1961	5	663	3,441
1959	5	919	4,663	1962	5	601	3,122

Lime.—Lime production increased 4 percent in quantity and 2 percent in value as compared with that of 1961. Most of the lime was produced in oil-fired rotary kilns for chemical and other industrial uses; 92 percent of the output was used by producing companies. Sales outside the State were principally to Maine, New Hampshire, Ohio, and Canada. The leading lime producing counties were Onondaga, Niagara, and Erie.

Magnesium Compounds.—Carborundum Metals Co., Division of the Carborundum Co., recovered a small quantity of magnesium chloride as a byproduct of zirconium production at its Akron, Erie County, plant.

Nitrogen Compounds.—Atmospheric nitrogen was recovered at Niagara Falls, Niagara County, by E. I. du Pont de Nemours & Co., Inc., and Olin-Mathieson Chemical Corp. Anhydrous ammonia made from the nitrogen was used in fertilizers, explosives, and other chemical and industrial applications.

Perlite.—Both quantity and value of expanded perlite produced were lower than that of 1961. Crude perlite mined in several western States was expanded at 6 plants; 3 in Erie County and 1 each in Bronx, Genesee, and Onondaga Counties. The most important use for expanded perlite was in building plaster which accounted for 85 percent of sales. Smaller quantities were used for loose fill insulation, aggregate in ultralightweight concrete, and soil conditioning. Minor quantities were used as a filler, filter aid, and for miscellaneous purposes.

Salt.—Demand for salt continued to grow; tonnage increased 7 percent and value increased 5 percent. In terms of value, New York continued to rank second among the 17 salt-producing States. Salt of all three types (evaporated, rock, and brine) was produced in greater tonnage and sold at higher total value than in 1961.

The average value of evaporated salt increased $1.05 per ton to $23.52, but the average value per ton for rock salt decreased $0.49 to $5.54 per ton. The unit value of salt in brine was unchanged. Evaporated salt, recovered mainly by the vacuum-pan process, was an important chemical raw material. Large quantities of rock salt were used in manufacturing chlorine and for ice control on highways. Salt was produced in Livingston, Onondaga, Schuyler, Tomkins, and Wyoming Counties and was shipped to most States in the East and Middlewest.

TABLE 3.—Salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953-57 (average)	3,616	$24,173	1960	4,008	$30,763
1958	3,896	30,609	1961	4,149	30,761
1959	4,011	30,958	1962	4,456	32,236

Sand and Gravel.—Sand and gravel production increased 5 percent in quantity and 3 percent in value. Commercial producers sold more sand and gravel than in 1961 although the average value per ton dropped to $1.12, 3 cents per ton below the 1961 average. Output of industrial sand for molding, engine sand, filtration, and other uses increased slightly, but the average value was $2.99 per ton as compared with $3.10 per ton in 1961.

Of 311 commercial sand and gravel operations reported, more than 2 million tons was produced at one plant; from 1 to 2 million tons at 5 plants; and from 0.5 to 1 million tons at 4 plants. The output of the 10 largest operations was 43 percent of all commercially produced sand and gravel in the State. Shipments were by truck (79 percent), by railroad (6 percent), and by waterway (15 percent). Eighty-nine percent of the output of commercial plants was washed and screened; unprocessed, bank run material was used principally for fill. Nassau and Suffolk Counties ranked first and second in sand and gravel production; output was reported from 54 of the 62 counties in the State.

Stone.—The value of stone produced increased 8 percent, as compared to the value in 1961, and ranked second among the 20 mineral commodities mined in the State. Total tonnage increased 2 percent, indicating a general upward trend in production although output of

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	8,757	$10,215	9,451	$11,231
Paving	5,087	5,525	5,846	6,027
Fill	597	233	725	376
Molding	174	683	160	624
Filtration	10	12	(1)	(1)
Other	664	636	695	641
Undistributed [2]	74	97	104	165
Total	15,363	17,401	16,981	19,064
Gravel:				
Building	4,096	5,852	4,391	6,063
Paving	3,737	4,473	4,268	4,383
Fill	1,201	612	1,307	714
Undistributed [3]	932	773	592	603
Total	9,966	11,710	10,558	11,763
Total sand and gravel	25,329	29,111	27,539	30,827
Government-and-contractor operations: [4]				
Sand:				
Building			42	16
Paving	71	51	32	19
Fill	477	260	84	6
Other	229	88	319	137
Total	777	399	477	178
Gravel:				
Building			8	3
Paving	1,003	369	1,139	308
Fill	875	571	284	30
Other	59	21		
Total	1,937	961	1,431	341
Total sand and gravel	2,714	1,360	1,908	519
All operations:				
Sand	16,140	17,800	17,458	19,242
Gravel	11,903	12,671	11,989	12,104
Grand total	28,043	30,471	29,447	31,346

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes engine sand, railroad ballast (1961), other sand, and data indicated by footnote 1.
[3] Includes railroad ballast and other gravel.
[4] Includes data for State, counties, municipalities and other Government agencies.

miscellaneous stone and slate was lower than in 1961. Stone was mined in 37 of the 62 counties of which Dutchess, Rockland, Onondaga, Erie, Ulster, and Monroe Counties, in decreasing order of magnitude, had output valued at more than $2 million. Stone mined in each of seven other counties was valued at more than $1 million. Production of crushed and broken stone by commercial operators increased 12 percent in tonnage and 16 percent in value; average value per ton rose 6 cents.

Crushed and broken limestone used principally for concrete aggregate, roadstone, cement, and lime accounted for 86 percent of the quantity and 80 percent of the value of all stone produced in the State.

TABLE 5.—Sand and gravel production by Government-and-contractor operations, by counties

(Short tons)

County	1961	1962	County	1961	1962
Cattaraugus	11,940	7,112	Oneida	16,050	55,112
Cayuga		6,750	Onondaga	6,504	54,942
Chautauqua	199,443	174,211	Ontario	16,455	84,172
Chemung	13,230	6,500	Orange	75,842	79,131
Columbia	35,000	4,490	Orleans	16,167	12,867
Delaware	21,821	13,270	Oswego	50,000	35,000
Dutchess	29,039	11,239	Otsego	45,900	37,800
Essex	9,500	29,350	Rensselaer		(1)
Franklin	72,519	134,052	St. Lawrence	51,764	259,551
Fulton	2,610		Saratoga	54,393	40,000
Genesee	31,412	(1)	Schenectady	11,463	39,697
Hamilton		7,350	Schuyler	35,500	32,400
Herkimer	25,246	57,054	Seneca	5,962	23,294
Jefferson	144,986	58,965	Steuben	108,700	(1)
Lewis	116,094	7,500	Suffolk		68,067
Livingston	13,440	12,320	Washington	12,600	23,301
Montgomery	4,579		Wayne	89,116	72,259
Niagara		7,935	Undistributed [2]	1,387,037	452,955
			Total	2,714,312	1,908,646

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes data unspecified by counties and data indicated by footnote 1.

Dutchess County continued to rank first in tonnage and value of limestone production. Dimension limestone, quarried in Greene, Onondaga, and Washington Counties, was used chiefly for rubble.

The quantity of basalt (traprock) produced and the average value per ton increased significantly as compared with output in 1961. Basalt, mined only in Rockland County, was used principally for concrete aggregate and roadstone. Sandstone was produced mainly in Delaware, Sullivan, and Broome Counties and was marketed for use as both dimension and crushed stone. Increased tonnage and value were reported in both categories. The principal uses of dimension sandstone in decreasing order of value were flagging and dressed, sawed, and rough construction stone. Delaware County ranked first in value of dimension sandstone; Sullivan County had the greatest value of crushed sandstone.

Demand for dimension slate for roofing and flagging continued to be good, but the transfer of operations by certain producers from slate quarries in Washington County to quarries in adjacent Rutland County, Vermont, caused a sharp decrease in tonnage and value in New York. No sales of crushed slate were reported during the year. Dimension granite quarried in Westchester County was used for rough construction, dressed construction, rubble, and rough architectural stone; granite mined in Warren and Westchester Counties was crushed for use as concrete aggregate, roadstone, and railroad ballast. Output of miscellaneous stone for concrete aggregate, roadstone, and stone sand was less than in 1961. Marble mined in St. Lawrence and Westchester Counties was crushed and ground for a variety of uses.

Talc.—New York continued to be the leading U.S. talc-producing State. Crude talc was recovered from mines in the Gouverneur district of St. Lawrence County by two companies. The crude rock was trucked to nearby mills where it was dried and finely ground for use principally in ceramics, paint, and composition floor and wall tile.

TABLE 6.—Crushed and broken limestone sold or used by producers, by uses

(Thousand short tons and thousand dollars)

Use	1961		1962	
	Quantity	Value	Quantity	Value
Riprap	85	$133	159	$272
Concrete aggregate and roadstone	16,148	25,669	14,739	26,270
Fluxing stone	63	102	51	82
Agricultural	426	1,240	340	935
Railroad ballast	327	532	588	952
Cement and lime	5,034	5,188	5,930	5,782
Miscellaneous uses	1,952	3,449	2,021	3,619
Total [1]	24,035	36,313	23,827	37,913

[1] Data may not add to totals shown because of rounding.

Quantities also were sold for use as a lubricant and as a mineral pulp filler in various products.

Vermiculite.—Crude vermiculite mined in other states was exfoliated at a plant in Oneida County. Principal uses for expanded vermiculite were in acoustical and fireproofing plaster, ultralightweight concrete, loose fill insulation, and agriculture.

Wollastonite.—Wollastonite was mined and ground for use as a filler in paints and plastics and as an ingredient in ceramic products in Essex County by Cabot Minerals Division, Cabot Corp. Adirondack Development Corp., which has a wollastonite deposit near Lewis, Essex County, obtained approval of its application for financial assistance from Area Redevelopment Administration to build a pilot plant. The pilot plant was to be used to solve technical problems relating to ultrafine grinding of wollastonite. Cabot Corp. planned to participate in the project.

METALS

Aluminum.—Activation of the third and final potline at Reynolds Metals Co. plant in Massena, St. Lawrence County, marked the first time the plant operated at its 100,000 short ton annual capacity since construction was completed. Combined capacity of the Massena plants of Reynolds Metals Co. and Aluminum Company of America represented about 9 percent of U.S. primary aluminum capacity. Production of aluminum increased during the year. Construction of a new 100-inch aluminum rolling mill by Alroll, Inc., Oswego County, was near completion at yearend. The facility was planned to roll primary aluminum ingot made in Canada for fabrication by Cerro Aluminum Corp., Bridgeport Brass Co., and Scovill Manufacturing Co.

Ferroalloys.—Shipments increased 4 percent to 90,000 tons, but the value ($19.7 million) was 2 percent lower than that of 1961. Production exceeded shipments by 1,000 tons, indicating that producers made only minor adjustments to inventories of finished ferroalloys as compared to the 16 percent inventory reduction made in 1961. Quantity and value of silvery pig iron was higher than in 1961, but shipments of ferromanganese and ferrochrome were lower. The average values of ferrosilicon and ferrochrome-silicon were steady and the tonnage shipped was higher. Silicomanganese shipments

were down 4 percent but the average value was higher. Other ferroalloys shipped included ferrotitanium, ferrocarbon-titanium, ferrotungsten, ferrocolumbium, ferroboron, ferro-aluminum-zirconium, and ferrotantalum-columbium.

TABLE 7.—Ferroalloy producers in 1962

Company	Location	Type of furnace	Ferroalloys produced [1]
Hanna Furnace Corp.	Erie County, Buffalo	Blast	Silvery pig iron.
Pittsburgh Metallurgical Co.	Niagara County, Niagara Falls.	Electric	FeMn, SiMn, FeSi, FeCr, silvery pig iron.
Titanium Alloy Manufacturing Division of National Lead Co.	do	do	FeTi, FeB, FeZr.
Union Carbide Metals Co.	do	do	FeCr, FeTi, FeW, FeB, FeCb FeCbTa, SiMn, FeSi.
Transition Metals & Chemical Co.	Ulster County, Walkill	Thermit	FeCb.

[1] Symbols: FeMn, ferromanganese; SiMn, silicomanganese; FeSi, ferrosilicon; FeCr, ferrochromium; FeTi, ferrotitanium; FeW, ferrotungsten, FeB, ferroboron; FeCb, ferrocolumbium; FeCbTa, ferrocolumbium-tantalum; FeZr, ferrozirconium.

Iron Ore.—Although the tonnage of usable iron ore shipped was 6 percent greater than that in 1961, the value was 2 percent lower as the average value per ton dropped $1.06 to $11.88. Magnetite was produced by three companies from four mines, two in Essex County and one each in Clinton and St. Lawrence Counties. Eighty-six percent of the tonnage was from open pit mines. All of the ore was beneficiated and most of the concentrate was agglomerated before shipment. A quantity of hematite, mined underground in Oneida County, was ground for use as iron oxide pigment.

Iron and Steel.—Shipments of pig iron amounting to 4 million tons valued at $234 million were reported by five companies operating six plants; four in Erie County and one each in Niagara and Rensselaer Counties. Basic pig iron made up 80 percent of the total. Other classes of pig iron in decreasing order of tonnage were malleable, Bessemer, low-phosphorus, and foundry. Most of the iron ore was of domestic origin, but 20 percent was imported from Canada, Chile, Sweden, and Liberia. In addition to hot metal and pig iron, materials used in blast furnaces were limestone, dolomite, mill cinder and scale, flue dust, open-hearth and Bessemer slag, coke, anthracite coal, and scrap iron and steel.

With production of 4.7 million tons, New York ranked seventh among steel producing States. According to the American Iron and Steel Institute, open-hearth output, which was 97 percent of the total, rose 2 percent. Electric furnace steel tonnage increased 8 percent to 139,000 tons.

Construction of a continuous strip-galvanizing unit was completed in November at the Lackawanna plant of Bethlehem Steel Co. The galvanizing unit had an annual capacity of 200,000 tons of sheet steel and accommodated sheets up to 72 inches wide and 0.168 inches thick (8 gage). Experimental use of oxygen lancing was begun in September at the Buffalo Plant of Republic Steel Corp. A study was planned to determine the economic feasibility of suitably controlling stack discharge resulting from use of the oxygen lance process. Crucible Steel Co. of America had a 26-inch Blooming mill under construction

at its Syracuse plant. Also under way at the Syracuse plant were improvements to provide greater efficiency and flexibility in the finishing mill. Allegheny Ludlum Steel Corp. added bar drawing equipment at its Dunkirk plant and additional billet grinders at its Watervliet plant. A new electric furnace melt shop to double present capacity was under construction at the Lockport Steel Mill Division of Simonds Saw & Steel Co. in Niagara County.

Lead.—The Balmat Mine in St. Lawrence County was the only lead producer in the State. Output of metal increased 21 percent, but the total value rose only 8 percent because the selling price decreased 11 percent. Output was greater than that for any year since 1957.

Lead was processed by National Lead Co., Brooklyn, to produce red lead and litharge. Electric Auto-Lite Battery Corp., Niagara Falls, manufactured black lead oxide.

Silver.—The quantity of silver recovered from lead concentrates shipped from the Balmat Mine, St. Lawrence County, was less than half that of 1961. Silver recovery reflected the demand for silver-free lead rather than the silver content of the concentrate. The average value of silver rose from $0.92449 per ounce in 1961 to $1.08519 in 1962.

TABLE 8.—Mine production of silver, lead, and zinc, in terms of recoverable metals

Year	Mines producing	Material sold or treated (short tons)	Silver		Lead		Zinc		Total value (thousands)
			Troy ounces	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	2	655,533	56,835	$52	1,387	$398	56,303	$13,516	$13,966
1958	2	563,644	66,738	60	579	136	53,014	10,815	11,011
1959	2	438,769	51,588	47	481	111	43,464	9,997	10,155
1960	2	701,197	49,324	45	775	181	66,364	17,122	17,348
1961	2	592,438	40,507	37	879	181	54,763	12,595	[1] 12,813
1962	3	596,452	19,451	21	1,063	196	53,654	12,340	12,557

[1] Revised figure.

TABLE 9.—Mine production of silver, lead, and zinc in 1962, by months, in terms of recoverable metals

Month	Silver (troy ounces)	Lead (short tons)	Zinc (short tons)	Month	Silver (troy ounces)	Lead (short tons)	Zinc (short tons)
January	645	117	4,341	August	1,530	61	4,710
February	2,295	113	4,316	September	1,148	71	4,578
March	2,104	91	4,670	October	1,497	84	4,900
April	2,129	102	4,561	November	2,015	101	4,297
May	1,156	92	4,422	December	1,437	78	3,658
June	2,337	84	4,728				
July	1,158	69	4,473	Total	19,451	1,063	53,654

Titanium Concentrate (Ilmenite).—Ilmenite concentrate was recovered as a coproduct of magnetite from an open cut titaniferous-magnetite deposit near Tahawus, Essex County. Mine production, shipments, and total value were 7 percent higher than in 1961. Ilmenite concentrate was used principally in the manufacture of titanium dioxide pigment.

Zinc.—Although production and value of zinc dropped 2 percent, New York continued to rank third in the Nation. Zinc was mined at the Balmat and Edwards mines in St. Lawrence County.

Zirconium.—Refractories and compounds of zirconium were manufactured in New York although no ore of zirconium was mined in the State. Zirconium oxide was manufactured by Titanium Alloy Manufacturing Division of National Lead Co., Niagara Falls, and Harbison-Carborundum Corp., Falconer, Chautauqua County. Zircon and zirconia refractories were made by Harbison-Carborundum Corp. and Corhart Refractories Co., Corning, Steuben County. Stauffer Chemical Co., Niagara Falls, was building a new plant to replace existing zirconium tetrachloride facilities. The new plant, scheduled to go into operation in the first quarter of 1963, was planned to have an annual capacity in excess of 20 million pounds. Zirconium ferroalloy was manufactured by Union Carbide Metals Co. at Niagara Falls.

MINERAL FUELS

Coke and Coal Chemicals.—Allied Chemical Corp. produced coke and coal chemicals in 120 Semet-Solvay ovens at its Buffalo plant; benzene, toluene, and xylene were recovered from light oil at the company's Syracuse plant. Bethlehem Steel Co., Lackawanna, operated a captive byproduct coke plant utilizing 535 ovens. Donner-Hanna Coke Corp., Buffalo, produced coke and coal chemicals in a captive plant consisting of 150 ovens. Under construction by Donner-Hanna Coke Corp. were 50 Koppers-Becker ovens, a 33 percent increase in the number of ovens.

Of the 3 million tons of coke consumed in New York, 92 percent was used at blast furnace plants; most of the balance was used in foundries and industrial plants, and less than 1 percent was used for residential heating. Most of the coke used was manufactured in the State. Coke breeze (finely divided material) amounting to 258,000 tons was used for fuel.

Natural Gas.—Production and value of natural gas decreased 26 percent and 29 percent, respectively, compared with that of 1961. Estimated proved recoverable reserves of natural gas, according to the American Gas Association, were 131.9 billion cubic feet as of December 31, 1962; a net increase of 3.6 billion cubic feet for the year. Reserves consisted of 41 billion cubic feet of native gas and 90.0 billion cubic feet of gas in underground storage. Drilling activity increased as 24 field wells and 19 successful wildcats were completed as compared to 11 field wells and 5 successful wildcats in 1961. Dry holes in 1962 totaled 37 bringing the number of wildcat completions to 56. In all, wildcat holes were drilled in 17 counties with successful completions in 11 counties. The greatest wildcatting activity was in Cattaraugus, Chautauqua, Livingston, and Wyoming Counties. The total footage for all completed wildcat wells drilled during the year was 155,731 for an average depth of 2,781 feet.

Peat.—Reed-sedge peat was produced in Seneca and Orange Counties, and humus peat was produced in Westchester County. Quantities produced and sold increased significantly, but the average value per ton dropped $3. Sales of packaged peat accounted for slightly

more than one-third of the total tonnage. Most of the output was used for soil improvement; minor quantities were consumed in potting soils, seed inoculant, mushroom beds, and other applications.

Petroleum.—Production of petroleum increased in quantity and value, but the average value dropped from $4.76 in 1961 to $4.60 per barrel. Petroleum was produced in Allegany, Cattaraugus, and Steuben Counties in Southwestern New York. The number of productive wells at yearend was estimated to be 13,537. Of these, 12,407 were artificial lift oil wells, 1,125 were gas wells, and 5 were condensate gas wells. Virtually all of the New York crude oil was treated in Pennsylvania refineries.

Proved reserves of crude oil at the end of 1962, as estimated by the American Petroleum Institute, were 23.1 million barrels, 17 percent less than at the end of 1961. Thirty-five percent of the reduction in proved reserves represented 1962 production and 65 percent resulted from downward revision of previous estimates.

All the new wells drilled during the year were put down by cable-tool rigs. Depths of the wells were all in the 1,250- to 2,500-foot range. No crude oil wildcats were reported.

Refinery and cracking plant capacities were 90,500 and 32,300 barrels of crude petroleum per day, respectively, the same as in 1961. Mobil Oil Co. operated plants in Brooklyn, Kings County, and Buffalo, Erie County. Frontier Oil Refining Corp., Division of Ashland Oil and Refining Co. processed crude oil at its Tonawanda, Erie County, plant. The plants at Tonawanda and Buffalo were skimming, cracking, and asphalt plants; the Brooklyn plant had skimming and cracking facilities only.

Texaco, Inc., at its Beacon, Dutchess County, laboratory, conducted research on the use of fuels, lubricants, and greases; nuclear problems; petro-chemical and process development; product improvement; and development of new products.

TABLE 10.—Petroleum production

(Thousand barrels and thousand dollars)

Year	Quantity	Value	Average value per barrel	Year	Quantity	Value	Average value per barrel
1953–57 (average)	3,077	$12,493	$4.06	1960	1,813	$8,412	$4.64
1958	1,763	7,457	4.23	1961	1,658	7,892	4.76
1959	1,970	8,353	4.24	1962 [1]	1,789	8,229	4.60

[1] Preliminary figures.

TABLE 11.—Well completions and drilling footage for field wells and wildcats in 1962

Type of well	Field wells		Wildcats		Total	
	Well completions	Drilling footage	Well completions	Drilling footage	Well completions	Drilling footage
Crude	148	193,642			148	193,642
Gas	24	51,639	19	42,845	43	94,484
Dry	14	28,555	37	112,886	51	141,441
Service	74	92,843			74	92,843
Total	260	366,679	56	155,731	316	522,410

Source: Oil and Gas Journal. V. 61, No. 4, Jan. 28, 1963.

REVIEW BY COUNTIES

Mineral output was reported from all except five counties. St. Lawrence County continued to be the leading mineral-producing county, although its mineral production was valued at $3.4 million less than in 1961. The values of iron ore and zinc production decreased but that of talc was higher. Other leading mineral producing counties, in decreasing order of value, were Onondaga, Greene, Erie, and Columbia.

Albany.—The Callanan Road Improvement Co. produced limestone for flux, riprap, concrete aggregate, railroad ballast and agricultural purposes at South Bethlehem. Sandstone was quarried by Heldeberg Bluestone & Marble, Inc., East Berne, and cut for architectural uses. Quantities were also used for flagging and irregular facing stone. Construction was completed and production begun at the Ravena plant of Atlantic Cement Co., Inc. Shipments to distribution centers began in October. Deliveries were made in the company-owned seagoing barge that had a capacity of 90,000 barrels of cement.

TABLE 12.—Value of mineral production in New York, by counties[1 2]

County	1961	1962	Minerals produced in 1962 in order of value
Albany	(3)	$2,435,944	Stone, cement, clays, sand and gravel.
Allegany	$311,190	387,227	Sand and gravel.
Broome	1,023,096	1,082,417	Sand and gravel, stone, clays.
Cattaraugus	833,722	1,055,844	Sand and gravel.
Cayuga	542,243	(3)	Stone, sand and gravel.
Chautauqua	160,884	154,849	Sand and gravel.
Chemung	(3)	(3)	Do.
Chenango	(3)	(3)	Do.
Clinton	(3)	2,745,588	Iron ore, stone, sand and gravel, lime.
Columbia	(3)	(3)	Cement, stone, sand and gravel, clays.
Cortland	116,430	110,970	Sand and gravel.
Delaware	(3)	1,208,146	Stone, sand and gravel.
Dutchess	(3)	(3)	Stone, sand and gravel, clays, gem stones.
Erie	r16,458,651	15,970,902	Cement, stone, sand and gravel, gypsum, lime, clays.
Essex	(3)	(3)	Ilmenite, iron ore, wollastonite, sand and gravel, garnet.
Franklin	178,582	131,926	Stone, sand and gravel.
Fulton	120,639	113,090	Sand and gravel.
Genesee	2,746,949	2,699,088	Stone, gypsum, sand and gravel.
Greene	(3)	18,382,762	Cement, stone, sand and gravel, clays.
Hamilton		(3)	Sand and gravel.
Herkimer	(3)	(3)	Stone, sand and gravel, gem stones.
Jefferson	1,172,171	1,085,923	Stone, sand and gravel.
Lewis	(3)	(3)	Do.
Livingston	(3)	(3)	Salt, sand and gravel, stone.
Madison	387,341	490,124	Stone, sand and gravel, gem stones.
Monroe	3,087,608	3,609,017	Stone, sand and gravel, gypsum.

TABLE 12.—Value of mineral production in New York, by counties[1 2]—(Con.)

County	1961	1962	Minerals produced in 1962 in order of value
Montgomery	(3)	$485,419	Stone, sand and gravel.
Nassau	$6,957,741	8,142,261	Sand and gravel, clays.
Niagara	(3)	3,941,578	Lime, stone, sand and gravel.
Oneida	(3)	2,732,067	Stone, sand and gravel, iron ore, gem stones.
Onondaga	(3)	18,418,280	Lime, salt, stone, cement, sand and gravel, clays.
Ontario	(3)	1,410,458	Stone, sand and gravel.
Orange	1,172,566	1,037,964	Sand and gravel, clays, stone, peat.
Orleans	(3)	105,579	Sand and gravel.
Oswego	(3)	377,940	Do.
Otsego	(3)	166,475	Stone, sand and gravel, gem stones.
Putnam	(3)	(3)	Sand and gravel.
Rensselaer	(3)	903,464	Sand and gravel. stone, clays.
Richmond	----------	24	Gem stones.
Rockland	(3)	7,144,528	Stone, sand and gravel.
St. Lawrence	35,280,891	31,872,825	Iron ore, zinc, talc, stone, lead, sand and gravel, silver.
Saratoga	(3)	1,161,646	Stone, sand and gravel.
Schenectady	(3)	256,272	Sand and gravel.
Schoharie	(3)	(3)	Cement, stone, clays, sand and gravel.
Schuyler	(3)	(3)	Salt, sand and gravel.
Seneca	(3)	(3)	Peat, sand and gravel.
Steuben	(3)	527,549	Sand and gravel.
Suffolk	6,946,922	6,364,386	Do.
Sullivan	(3)	(3)	Stone, sand and gravel.
Tioga	350,867	296,421	Sand and gravel.
Tompkins	(3)	(3)	Salt, stone, sand and gravel.
Ulster	(3)	12,598,042	Cement, stone, clays, sand and gravel.
Warren	(3)	(3)	Cement, garnet, stone, gem stones.
Washington	789,646	632,954	Stone, sand and gravel.
Wayne	(3)	(3)	Do.
Westchester	730,334	779,858	Stones, sand and gravel, emery, peat.
Wyoming	(3)	(3)	Salt, stone.
Undistributed	[4][5]154,465,326	90,872,570	
Total [6]	[4]233,833,000	241,892,000	

[1] Bronx, Kings, New York, Queens, and Yates Counties are not listed because no production was reported.
[2] Fuels, including natural gas and petroleum, not listed by counties; value included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Revised figure.
[5] Includes natural gas and petroleum, some gem stones and sand and gravel that cannot be assigned to specific counties, and values indicated by footnote 3.
[6] Data may not add to totals shown because of rounding.

Powell & Minnock Brick Works, Inc., acquired Roah Hook Brick Co. and Sutton & Suderley Brick Co., both of Coeymans. Miscellaneous clay was produced for building brick. Industrial Mineral Products, Inc., acquired Rex Clay Products, Inc., and produced Albany slip clay for use as a bond for abrasives and refractories and as a glaze for electrical porcelain, graphite, and stoneware. Certified Industries, Inc., acquired Northern Lightweight Aggregates, Inc., Cohoes, in August 1961. The company continued to produce lightweight aggregate in its enlarged plant from shale mined at its nearby pit.

Whitehead Brothers Company produced molding sand from pits near Selkirk and Slingerland. Albany Gravel Company, Inc., Albany, and J. H. Maloy, Inc., Loudonville, produced sand and gravel for building and paving.

Allegany.—Alfred Atlas Gravel & Sand Corp., Buffalo Slag Co., Inc., both near Alfred, and Thomas Moogan, Friendship, produced sand and gravel for building and paving. Sand for ice control was produced by Nick Codispoti from a pit near Belmont.

Bronx.—National Gypsum Co. calcined gypsum at its Bronx plant. Perlite mined in Colorado was also expanded at the same plant. Most of the calcined gypsum and expanded perlite was shipped to other company plants for use in manufacturing building plaster and wallboard; the remainder was used at the Bronx plant.

Broome.—Commercial sand and gravel output increased and consisted chiefly of processed building and paving material. Producers were Barney & Dickenson, Inc., Winnie & Son, Inc., Bob Murphy, Inc., all near Vestal, and Binghamton Sand & Crushed Stone Corp. and Weber's Sand and Gravel, both near Binghamton. Corbisello Quarries produced crushed and broken sandstone for concrete aggregate and riprap near Binghamton. Dimension sandstone (bluestone) was quarried and shipped to Delaware County for fabrication. Miscellaneous clay was produced by the Binghamton Brick Co., Inc., Binghamton, for manufacturing building brick.

Cattaraugus.—Production of sand and gravel by commercial producers increased 36 percent to 932,000 tons. The output was used for building and paving; part of the tonnage was sand for filtration and ice control. Principal production was from pits near Allegany, Franklinville, and Gowanda.

Cayuga.—General Crushed Stone Co., Auburn, quarried and crushed limestone for concrete aggregate, roadstone, and railroad ballast. J. J. Harrington and Jay W. Robinson & Son, both near Auburn, produced sand and gravel for building and paving.

Chautauqua.—Production of commercial sand and gravel came principally from pits near Jamestown and Bemus Point. Output was used mainly for building and paving.

Chemung.—Elmira Transit Mix, Inc., and Dalrymple Gravel & Constr. Co., Inc., both near Elmira, Frank Treat, Breesport, and E. R. Wolcott, Inc. (formerly Walcott Sand & Gravel), Big Flats, produced sand and gravel for building and paving. Consolidated Brick Co., Horseheads, closed permanently.

Chenango.—B & B Builders Supplies, Greene, and The Bundy Concrete Co., Sherburne, produced sand for building and gravel for building, paving, and fill. Most of the output was washed and screened; all was delivered by trucks.

Clinton.—Iron ore (magnetite) was mined by sublevel stopes at Republic Steel Corp. Chateaugay Mine, Lyon Mountain. Development work included deepening a shaft, driving levels, raising, and driving sublevel tunnels in preparation for mining additional blocks of ore. The open pit was not operated during the year. Concentrates prepared in the mill were mixed with anthracite coal and limestone and sintered before shipment for use in the manufacture of pig iron and steel. Mine waste (gneiss) was crushed and screened for concrete aggregate, roadstone, and stone sand.

International Lime & Stone Corp. produced limestone, which was used for metallurgical flux, concrete aggregate, agstone, and kiln feed, at the company lime plant near Chazy. Both quick and hydrated lime were produced; most was shipped to consumers in other States for chemical and agricultural uses. Plattsburg Quarries, Inc., quarried limestone for concrete aggregate and roadstone. Building and paving sand and gravel was produced from a pit near Morrisonville by Bero Construction Co.

Columbia.—Columbia County continued to rank second in cement production. Lone Star Cement Corp., Greenport, and Universal Atlas Cement Div., United States Steel Corp., Hudson, produced masonry and portland cement. The principal raw materials were limestone

and clay from company operated limestone quarries and clay pits. Shipments were chiefly to consumers in New York and the New England States. Limestone was quarried by Catskill Mountain Stone Corp. and A. Colarusso & Son, Inc., Greenport, for use as riprap, concrete aggregate, agstone and other uses. Sand for building and paving was produced from a pit near Livingston by F. H. Stickles & Son. Various operators produced sand and gravel for paving. Most of the sand was used for ice control.

Cortland.—Cortland Ready Mix Concrete, Inc., produced sand and gravel from a pit near Cortland. Part of the output was used as aggregate in ready mixed concrete, the rest was used in building and highway construction.

Delaware.—Delaware County continued to lead the State in value of sandstone production. Sandstone was mined and crushed for concrete aggregate and roadstone by one producer near Hancock. Dimension sandstone from the Cole quarry near Masonville was recovered and processed by American Bluestone Co. Johnston & Rhodes Bluestone Co., Paul Thompkins Estate, W. R. Strong & Son, and Willis Hankins processed stone mined by various producers in Delaware and Broome Counties, as well as from nearby quarries in Pennsylvania. Sawed, cut, and rough architectural stone, and curbing and flagstone were prepared at the finishing plants. Chips and spalls were sold for irregular facing stone, rubble, and riprap. Sand and gravel for highway construction was produced by Government-and-contractor operations.

Dutchess.—The county continued to rank first in value of limestone. New York Trap Rock Corp., New Hamburg, and Dutchess Quarry & Supply Co., Inc., Pleasant Valley, quarried and crushed limestone for concrete aggregate, riprap and railroad ballast. White Marble Corp., Wingdale, did not operate during the year. Dennings Point Brick Works, Inc., mined both miscellaneous clay and shale for manufacturing building brick.

Eighteen commercial operators reported sand and gravel production totaling 591,000 tons, 18 percent more than in 1961. The material was used as concrete aggregate, paving, and fill; all was delivered by truck. Circle Sand and Gravel, Inc., acquired Melito Sand & Gravel, Inc., Wappingers Falls, and continued to operate the plant.

Erie.—Portland and masonry cements were produced at Buffalo by Lehigh Portland Cement Co. and Penn-Dixie Cement Corp. Raw materials used in making cement at these plants included limestone, shale, clay, gypsum, sand, iron ore, and mill scale. The finished cement was shipped to consumers in New York and Western Pennsylvania.

Limestone quarries produced 1.6 million tons, 5 percent more than in 1961. The crushed and screened stone was sold for riprap, concrete aggregate, roadstone, agstone, and asphalt filler. Producers of limestone were Buffalo Crushed Stone Co., Div. Houdaille Construction Material Inc., Bowmansville; County Lime Stone Co., Inc., Akron; Federal Crushed Stone Corp., Cheektowaga; and Lancaster Stone Products Corp., Lancaster.

Gypsum was produced at three mines near Clarence Center. Universal Atlas Cement Co. shipped gypsum produced at its Clarence

Center mine to company-owned plants for use as a retarder in portland cement. Bestwall Gypsum Co. shipped crude gypsum produced at the Akron mine to the company's manufacturing plant at Akron, N.Y., where the gypsum was calcined and processed into plasterboard and other finished building materials. Bestwall also expanded crude perlite mined in Nevada and Colorado. National Gypsum Co. mined gypsum which was calcined at its nearby plant. Perlite shipped from other States also was expanded. Both expanded perlite and calcined gypsum were used in manufacturing building plaster and other building materials. Buffalo Perlite Corp., Cheektowaga, expanded perlite shipped from mines in Western States. The expanded perlite was used for acoustical plaster, loose-fill insulation, aggregate for ultralightweight concrete, soil conditioning, filler, and filter medium.

The quantity and value of commercially produced sand and gravel were greater than those in 1961, and the county continued to rank third in sand and gravel production. Most of the output was used for building, paving, and fill but a small tonnage of filtration sand was produced. Among the principal producers were Clarence Sand & Gravel Corp., Clarence; Pinehill Concrete Mix Corp., Lancaster; Dan Gernatt Gravel Products, Inc., Collins; and Jamieson Bank Run Gravel Corp., East Aurora. Quicklime for metallurgical flux was made by Kelley Island New York Corp. at its Buffalo plant.

Erie County dropped from first to second rank among shale producing counties even though the quantity produced was slightly higher than in 1961. More than half the tonnage of clay and shale produced in the county was used in manufacturing cement. Acme Shale Brick Co., Inc., Lakeview, and Buffalo Brick Corp., West Falls, mined miscellaneous clay for manufacturing building brick. Anchor Concrete Products, Inc., mined miscellaneous clay at its Orchard Park pit for manufacturing fired clay lightweight aggregate.

Essex.—Increased demand for steel was reflected in a sharp increase in production of iron ore. Republic Steel Corp. mined magnetite ore mainly by sublevel stopes at its Old Bed-Harmony mine at Mineville. The ore was concentrated and agglomerated at the nearby mill and sintering plant. Mine development during the year consisted of drifting and raising. Republic Steel Corp. Fisher Hill mine was idle in 1962. National Lead Co. mined a mixed ilmenite-magnetite ore at its MacIntyre Development near Tahawas. The ore was mined in an open cut consisting of 5 benches that had an average height of 41 feet. Mine production was facilitated during 1962 by adding a 4-cubic yard diesel powered shovel and 6 new 32-ton trucks. Separate concentrates of ilmenite and magnetite were prepared by heavy-medium separation, flotation, and magnetic separation. Both types of concentrate were agglomerated before shipment. Most of the iron ore produced in Essex County was used in making pig iron and steel, but part of the fine concentrates from the Tahawas operation were used in cement and as a heavy-medium in mineral dressing.

Cabot Minerals Division, Cabot Corp. produced wollastonite and byproduct garnet (andradite) from room and pillar stopes at its Willsboro mine. The wollastonite was beneficiated and finely ground for use as a filler in paints and plastics and as an ingredient in

ceramics. Additional stope areas were prepared for mining by drifting and raising. Adirondack Development Corp. began to set up a pilot plant with financial assistance from the Area Redevelopment Administration in cooperation with Cabot Corp. The pilot plant was planned for use in developing ultrafine grinding techniques to broaden markets for wollastonite. Sand and gravel was produced from pits near Saranac Lake, Elizabethtown, and Ticonderoga for use principally in building, road maintenance, and ice control.

Franklin.—Adirondack Stone Quarries, Inc., recovered rough blocks from its Burke sandstone quarry. The quarry blocks were dressed by splitting to produce architectural stone, flagging, and irregular facing stone. Franklin-Clinton Sandstone Co., Inc., was acquired by Adirondack Stone Quarries, Inc., during the year. Sand and gravel produced from pits near Malone and St. Regis Falls was used for manufacturing concrete products as well as for building, paving, and fill.

Fulton.—Sand and gravel was produced mainly from pits near Broadalbin, Gloversville, Johnstown, and Northville. Output was used for building, road maintenance, ice control, and the manufacture of concrete products; 10 pits were active.

Genesee.—Limestone was quarried and crushed by General Crushed Stone Co. and LeRoy Lime & Crushed Stone Corp., both of Leroy, and Genesee Stone Products Corp., Batavia. The crushed limestone was used for concrete aggregate, roadstone, railroad ballast, agstone, and riprap. Crude gypsum, mined nearby, was calcined by United States Gypsum Co. at its Oakfield plant. Production of sand and gravel was reported by Batavia Washed Sand & Gravel Co., Inc., and Western N.Y. Gravel & Concrete, both near Batavia, and Frey Sand & Gravel Corp., Alexander.

Greene.—Greene County continued to rank first in value of cement production. Alpha Portland Cement Co., Catskill, and Lehigh Portland Cement Co. and Marquette Cement Manufacturing Co., both near Alsen, produced portland and masonry cements. These companies also quarried limestone from nearby deposits for use as the principal cement raw material. In addition, Marquette Cement Manufacturing Co. mined clay from a nearby pit. Other ingredients used in making cement were bauxite, gypsum, iron ore, mill scale, and fly ash. Shipments of finished cement were principally to consumers in New York and New England. Crushed limestone was produced by Tri-County Asphalt & Stone Co., Inc., near Windham and Catskill Mountain Stone Corp. near Catskill. A quantity of molding sand was recovered from a pit near Coxsackie by Whitehead Brothers Co. Sand and gravel for concrete aggregate, roadstone, and for manufactured concrete products was produced from pits near Windham and Coxsackie.

Hamilton.—A quantity of sand and gravel was produced for highway maintenance by Government-and-contractor operations.

Herkimer.—Limestone for concrete aggregate, roadstone, railroad ballast, agstone, and riprap were produced by General Crushed Stone Co. from its quarry near Jordanville. Production of sand and gravel was reported from pits near Gravesville and Poland. Clear quartz crystals, known as Herkimer diamonds, were recovered by gem and mineral collectors from a locality near Middleville.

Jefferson.—Limestone for concrete aggregate, roadstone, asphalt filler, agstone, and railroad ballast was quarried near Watertown by General Crushed Stone Co. Multi-Color Sandstone Co. produced dimension sandstone for architectural use and flagstone. Production of 508,000 tons of sand and gravel was reported by 14 commercial producers. Pits were located principally near Watertown, Adams, and Belleville.

Lewis.—Carbola Chemical Co., Inc., Natural Bridge, mined, crushed, and ground limestone for use as mineral pulp. The finely ground limestone was used as a filler in ink, putty, calcimine, rubber, and asphalt. The product was also sold for use in manufacturing pottery, insecticides, and paper.

Livingston.—Livingston County continued to rank first in quantity and value of salt production. Rock salt recovered from room and pillar stopes at the Retsof mine of International Salt Co. was sold for the preparation of chemicals, food, paper, metals, ceramics and glass, rubber, oil, for ice control, and other uses. Shipments were made to 25 States, the District of Columbia, and Canada. Most sand and gravel produced in the county was mined by the Valley Sand & Gravel Corp. from pits near Canawaugus and Wadsworth and by Chester L. McMaster from a pit at Dansville. Limestone, quarried at Honeoye Falls by General Crushed Stone Co., was prepared for use as concrete aggregate and roadstone.

Madison.—Limestone for use as concrete aggregate, roadstone, agstone, and riprap was produced by Munnsville Limestone Corp., Munnsville, and Worlock Stone Co., Inc., Perryville. Cossitt Concrete Products Co., Inc., Hamilton, washed and screened sand and gravel for concrete aggregate and shipped a quantity of bank run material for fill. Specimens of the minerals celestite and calcite were collected near Chittenango Falls.

Monroe.—Limestone from quarries operated by Dolomite Products Co. at Penfield and Rochester, and by Concrete Materials, Inc., at Sweden was used for building, paving, railroad ballast, and agstone. Production of sand and gravel reported by eight producers amounted to 815,000 tons, a large increase compared with the output in 1961. Pits were located at Rochester, Spenceport, Scottsville, Pittsford, and Webster. All the output was delivered to consumers by truck. The Ruberoid Co. mined gypsum at Wheatland and shipped it to Caledonia for processing into gypsum building products.

Montgomery.—Cushing Stone Co., Inc., and Crushed Rock Products, Inc., both near Amsterdam, mined and crushed limestone for the construction industry. St. Johnsville Supply Co., Inc., produced processed sand and gravel for building, paving, and bankrun material for fill from its St. Johnsville pit.

Nassau.—Nassau County became the leading producer of sand and gravel; output was 7 million tons, 1 million tons higher than in 1961. Output consisted entirely of processed material and was used mainly for building and paving. Production was from pits located at Oyster Bay (2), Hicksville (2), Port Washington (2), North Hempstead, Roslyn, and Bellmore. Shipments were by truck and barge. Nassau Brick Co., Inc., made building brick from clay mined at a pit near Farmingdale.

Niagara.—Limestone produced by Royalton Stone Corp., Gasport, Frontier Stone Products, Inc., Lockport, and Niagara Stone Division, McLain Industries, Inc., Niagara Falls, was used principally for concrete aggregate, roadstone, railroad ballast, metallurgical flux, and agstone. A small quantity of sand and gravel was produced from a pit near Lockport.

International Paper Co., North Tonawanda, made quicklime for use in manufacturing paper. The company also recycled spent (hydrated) lime. Quicklime for use in making calcium carbide was produced in a three kiln plant. Hydrated lime (byproduct of acetylene production) was marketed principally in New York, Ohio, and Canada for metallurgical uses and sewage treatment.

Oneida.—Eastern Rock Products, Inc., mined and processed limestone mainly for concrete aggregate, roadstone, and riprap at its Prospect No. 6 and Oriskany Falls No. 5 quarries. Commercial sand and gravel output totaled 612,000 tons, compared with 488,000 tons in 1961. Output was reported from seven operations, the largest located at Gravesville, Boonville, and McConnellsville. Molding and other industrial sand was produced by George W. Bryant Core Sands, Inc., and Whitehead Bros. Co. Clinton Metallic Paint Co. mined crude red iron oxide pigment (hematite) by longwall methods at its Brimfield shaft mine near Clinton. The mineral was ground and prepared for use as pigment in paint and concrete. Mineral collectors obtained oolitic and other varieties of hematite. The Utica plant of Zonolite Co. continued to be the only facility for exfoliating vermiculite in the State. Crude material from company-owned mines in Montana and South Carolina was exfoliated and processed for use in various types of insulation.

Onondaga.—Onondaga County ranked second in value of total mineral production and of commercial limestone production. Limestone for highway construction and maintenance was produced at the Jamesville quarry of General Crushed Stone Co. Solvay Process Division, Allied Chemical Corp., quarried limestone at Jamesville for use mainly in manufacturing quicklime for producing alkalies. Some of the Jamesville production was sold for concrete aggregate, agstone, and railroad ballast. In addition, the company operated salt wells at Tully and a plant in Syracuse for producing evaporated salt and brine. The brine was used with the lime in the manufacture of soda ash. Evaporated salt, produced in vacuum pans, was used mainly for manufacturing chemicals. Portland and masonry cements were produced at Jamesville by Alpha Portland Cement Co. The company mined shale at a nearby pit for cement raw material and purchased limestone, sand, gypsum, and iron ore. Virtually all the cement produced was consumed in New York State.

Commercial production of sand and gravel totaled 1,452,000 tons compared with 935,000 tons in 1961. Nineteen pits were active, the principal producing areas were near Nedrow, Fayetteville, and East Syracuse. Most of the output was processed before shipment. Onondaga Brick Corp., Warners, produced fired clay lightweight aggregate by the sintering process from shale mined at the company's nearby pit. Red clay for manufacturing pottery and flower pots was mined near Camillus by Syracuse Pottery Co., Inc. Syracuse

Brick Corp. permanently discontinued operations. Minerals Processing Corp., Syracuse, expanded perlite shipped from Colorado and Utah. The expanded material was used principally in plaster, ultralightweight concrete, and for soil conditioning.

Ontario.—General Crushed Stone Co. produced limestone for highway and railroad construction and maintenance at its Oaks Corner quarry near Geneva. Commercial sand and gravel production amounted to 549,000 tons, 4,000 tons more than in 1961. Most of the output was washed and screened, and all was delivered by truck. Pits were located near Clifton Springs, Victor, Geneva, Oaks Corner, and Phelps.

Orange.—The quantity of sand and gravel produced by 13 commercial plants was 591,000 tons compared with 525,000 tons reported from 8 plants in 1961. Most of the output was processed for use as concrete aggregate and roadstone. Minor quantities of bankrun material were used for fill. Among the principal producers were Delaware Valley Sand & Gravel Co., Inc., Port Jervis, A. W. Hollenbeck, Inc., Chester, and Windsor Building Supplies Co., Inc., New Windsor. Jova Brick Works mined clay near Roseton for use in manufacturing building brick. Limestone for use in construction was quarried by Dutchess Quarry & Supply Co., Inc., Goshen. Reedsedge peat, recovered from a bog near Tuxedo by Sterling Forest Peat Co., Inc., was sold in package and in bulk.

Orleans.—Output of commercial sand and gravel reported by 6 commercial producers totaled 80,000 tons. Most of the washed and screened material was used as concrete aggregate; bankrun material was used principally for fill. Pits were located near Medina, Ridgeway, Shelby, Albion, and Barre. Clarendon Stone Co., Inc., discontinued production of limestone at its Clarendon quarry.

Oswego.—Sand and gravel for building, paving, and fill was produced from two pits near Oswego and one pit near Lacona. Whitehead Bros. Co. produced molding sand from a pit near Pulaski.

Otsego.—Limestone was quarried for use as concrete aggregate, roadstone, and riprap at Richfield Springs by Barrett Division, Allied Chemical Corp. Sandstone (bluestone) for architectural and rough construction uses was quarried near Oneonta. Seward Gravel Co., Milford, produced sand and gravel for building and paving and sand for ice control.

Putnam.—Leemac Sand & Stone Corp., Coldspring, produced washed sand and gravel for building and paving; bankrun material was sold for fill. Harlem Valley Crusher Co., Inc., Patterson, processed gravel for highway construction. The Patterson Limestone Quarry of Patterson Mineral Corp. was idle during the year. Mineral collectors obtained specimens containing chondrodite, dolomite, hornblende, magnetite, and enstatite near Tillie Foster.

Rensselaer.—Sand and gravel production from 10 pits in the county amounted to 442,000 tons. Output was used for building, paving, and fill. A quantity of sand was used for filtration and ice control. Graywacke was mined and crushed by Fitzgerald Bros. Construction Co., Inc., at its quarry near Brunswick for concrete aggregate and roadstone. Champlain Brick Co. produced Albany slip clay from

a pit near Schaghticoke for use as a bonding agent for artificial abrasive wheels and shapes.

Richmond.—United States Gypsum Co. calcined gypsum at its New Brighton plant for the manufacture of building products. Mineral collectors obtained specimens of talc and goethite on Grimes Hill near Wagner College, St. George.

Rockland.—The county regained its former rank of second in value of stone production. New York Trap Rock Co. quarried limestone at Tomkins Cove and basalt at Haverstraw and West Nyack. Output from these quarries was marketed as concrete aggregate, roadstone, and stone sand. Most of the company output from the Tomkins Cove and Haverstraw quarries was shipped by barge to consumers in the metropolitan New York area; most of the West Nyack production was transported to consumers by truck. Suffern Stone Co., Suffern, also quarried basalt for concrete aggregate and roadstone.

The quantity of sand and gravel produced from 6 pits was 11 percent less than that of 1961. Among the principal producers were Graney Building Material Corp., Sparkill, Mt. Ivy Sand & Gravel Co., Inc., Congers, Ramapo Sand & Gravel Corp., Hillburn, and Ward Pavement Inc., Thiells.

St. Lawrence.—Iron ore (magnetite) was mined by Jones & Laughlin Steel Corp. by open pit at the Benson mine near Star Lake in southern St. Lawrence County. Ore was broken on three benches averaging 50 feet high at the rate of about 13,500 long tons per day. Concentration processes included heavy-media separation, flotation, magnetic separation, and Humphrey spirals. Part of the concentrates were agglomerated by sintering before shipment. Most of the output was used in the manufacture of pig iron and steel.

Zinc, lead, and silver were produced at the Balmat mine, and zinc was recovered at the Edwards mine; both mines were operated by St. Joseph Lead Co. Sulfide ores were recovered from room and pillar stopes in both mines. Additional blocks of ore were prepared for mining by drifting and raising. New ore was outlined ahead of development by diamond drilling from underground. Zinc concentrate from both mines was shipped to the St. Joseph Lead Co. smelter at Josephtown, Pa., and lead concentrate from the Balmat mine was shipped to the company Herculaneum (Missouri) smelter for recovery of lead and silver.

International Talc Co., Inc., mined crude talc from its No. 3 mine near Edwards and Wight mine near Balmat. The talc ore was recovered from sublevel stopes. Blocks of ore were prepared for mining by development work consisting of tunneling and raising. Exploration and development by stripping was done at the Arnold mine, also near Balmat. Gouverneur Talc Co., Inc., mined talc by room and pillar and shrinkage stopes at its Balmat mine near Fowler. Development work was carried on at the Balmat mine to prepare blocks of ore for stoping. The company built an addition to the mill building and installed new milling machinery and storage bins. Finley ground talc was sold for use in ceramics and as a mineral filler.

Barrett Div., Allied Chemical Corp., Norwood, and McConville, Inc., Ogdensburg, produced limestone for concrete aggregate, roadstone, agstone, and riprap. Balducci Crushed Stone Co., Gouverneur,

mined and crushed marble for agstone and highway maintenance. Sand and gravel for construction was produced from nine pits in the county. Among the principal producers were George Cooke, Sprague-ville, and H. W. Gaines, Inc., and Putnam-Hawley Building Materials, Inc., both near Potsdam.

Saratoga.—Glens Falls Portland Cement Co., a division of The Flintkote Co., quarried limestone near Glen Falls for shipment to its cement plant in Warren County. Limestone for concrete aggregate, riprap, and agstone was produced by Pallette Stone Corp., Saratoga Springs. Commercial sand and gravel output totaled 225,000 tons compared with 236,000 tons in 1961. Processed molding sand and engine sand was recovered from pits near Jonesville, Ushers, Milton, Gansevoort. Sand and gravel for use in building, highway maintenance, and fill was produced from pits near Waterford, Saratoga Springs, and Corinth.

Schenectady.—Output of commercial sand and gravel amounting to 170,000 tons was less than that produced in 1961. Material was recovered from pits near Schenectady and Scotia for concrete aggregate and highway maintenance.

Schoharie.—Portland and masonry cements were manufactured at the Howes Cave plant of Marquette Cement Manufacturing Co. (formerly North American Cement Co.). The company mined limestone and shale at nearby pits and purchased sand, gypsum, and iron ore. The dry process was used to make cement in the company's four kilns. Shipments were principally to consumers in New York and New England and deliveries were made by truck and rail, principally in bulk. Other limestone producers were Cobleskill Stone Division of Allied Material Corp., Cobleskill, Masick Soil Conservation Co. and Schoharie Stone Corp., both near Schoharie. Stone was prepared for the construction industry by Cobleskill Stone and Schoharie Stone and for agricultural purposes by Masick. A small quantity of building sand was produced near Jefferson.

Schuyler.—International Salt Co., Inc., and Watkins Salt Co., Inc., both near Watkins Glen, pumped brine from salt wells. Most of the salt was produced in vacuum pans and some was sold in pressed blocks. Output was used chiefly by the chemical industry in New York and other Northeastern States. A small quantity was exported to Canada and other foreign countries. D. & T. Franzese Bros. produced building sand and gravel from a pit near Watkins Glen.

Seneca.—Finger Lakes Peat Moss Co. recovered reed-sedge from bogs near Junius. All of the peat produced was sold in bulk. Crews of the Seneca County Highway Department produced sand for ice control and gravel for paving.

Steuben.—The principal producers of sand and gravel were Bath Sand and Gravel Co., Bath; Rhinehart Sand & Gravel Inc., Corning; and Dalrymple Gravel and Contracting Co., East Corning. Most of the sand and gravel was washed and screened for building and paving; a small quantity of bank run material was used for fill.

Suffolk.—Suffolk County ranked second in quantity and value of sand and gravel produced. Commercial output decreased 6 percent in tonnage and 8 percent in value as compared to that of 1961. Of the 21 active commercial sand and gravel producers, 4 had output exceeding

500,000 tons; one produced over 1 million tons and another more than 2 million tons. Ninety-eight percent of all commercial output was washed and screened before shipment. More than half the output was delivered by waterway; the rest was delivered by truck. Two producers used dredges, and most of the rest processed the material in stationary plants.

Sullivan.—Concrete aggregate and stone sand were produced from quarries of Sullivan Highway Products Co. near Kenoza Lake and Thompson. Sand and gravel was produced from pits near Monticello, Mongaup Valley, and Summitville. The entire county output was shipped to consumers by truck, mainly as processed material for building and paving.

Tioga.—Sand and gravel, used mainly for building and paving, was produced near Owego by C. & C. Ready-Mix Corp. and Concrete Materials, Inc., near Barton by Herman E. Bunce, and near Waverly by A. O. Swanson.

Tompkins.—Cayuga Rock Salt Co., Inc., recovered rock salt from its underground mine near Myers. The product, used mostly in ice control for highways and by the chemical industry, was consumed mainly in the State. Principal shipments out of State were to Maine, Massachusetts, New Hampshire, New Jersey, Pennsylvania, and Virginia. International Salt Co., Ludlowville, pumped brine from wells to produce salt in vacuum pans until August when operations were discontinued. The refined salt was used principally as a chemical reagent and in food products.

Finger Lakes Stone Co., Inc., produced dimension sandstone (mainly architectural) at its University quarry near Dryden. Part of the output was flagging and irregular-shaped facing stone. Rumsey-Ithaca Corp. and University Sand & Gravel, both near Ithaca, processed sand and gravel chiefly for building purposes. Limestone was mined and crushed at the South Lansing quarry of Cayuga Crushed Stone, Inc., for construction.

Ulster.—Hudson Cement Division, Colonial Sand & Stone Co., Inc., produced portland cement at its Kingston plant. Limestone from a nearby quarry was the principal cement raw material. Most of the finished portland cement was shipped in bulk to consumers in New York by barge, railroad, and truck. Century Cement Manufacturing Co., Inc., made natural and masonry cements from cement rock mined underground. Masonry cement was shipped to consumers in New York, New Jersey, Eastern Pennsylvania, Connecticut, and Rhode Island. Callanan Road Improvement Co. produced limestone for concrete aggregate and roadstone at its No. 3 plant near Esopus. Most of the stone was shipped to consumers by waterway.

Ulster County ranked first in quantity of clay produced. Two new producers began mining shale to supply nearby lightweight aggregate plants that were completed and began operation during 1962. Star Brick Corp. and The Hutton Co., both near Kingston, mined miscellaneous clay for manufacturing building brick. Sand and gravel, used mainly as construction and paving material, was produced by Hurley Sand & Gravel Co., Inc., Hurley, and Jas. J. Van Vliet & Son, Inc., Marlboro.

Warren.—Glens Falls Portland Cement Co., Division of The Flintkote Co., produced portland and masonry cements by the wet process in three rotary kilns at its Glens Falls plant. The principal raw material was limestone (cement rock) quarried in Saratoga County. Gypsum, sand, and iron ore also were used as cement raw materials. Finished cement was shipped to consumers principally by truck and in bulk. Limestone was quarried near Glens Falls by Jointa Lime Co., Inc. Warren Aggregates, Inc., quarried and crushed granite at its pit near Chestertown for concrete aggregate, roadstone, and railroad ballast.

Abrasive garnet, mined by open pit methods, was processed at the North Creek plant of Barton Mines Corp. The carefully sized garnet was used for sandpaper, grinding and polishing glass, and lapping metal. Garnet gem and mineral specimens continued to be valued highly and were a popular target for gem and mineral collectors.

Washington.—The New York slate industry continued to be centered about Granville, Middle Granville, and Whitehall in Washington County. Output was used chiefly as roofing slate and flagstone. A quantity of bankrun gravel was produced from pits near Fort Ann, Eagle Bridge, and Salem. Tri-County Stone Co., Inc., Hudson Falls, produced crushed limestone for concrete aggregate and roadstone as well as coarsely broken stone for riprap, rubble, and irregular-shaped facing stone.

Wayne.—Limestone for concrete aggregate, roadstone, and agstone was quarried near Sodus by General Crushed Stone Co. Commercial sand and gravel for building, paving, and fill was recovered from pits near Galen, Red Creek, and Palmyra.

Westchester.—Lake Street Granite Quarry, Inc., White Plains, and DiRienzo Bros. and Baratta & D'Amato, both near Yonkers, quarried dimension granite mainly for construction. Dolomitic marble was quarried, crushed, and ground at the Thornwood plant of Universal Marble Products Corp. The product was used for terrazzo and cast stone, agriculture, stucco, asphalt filler, and in soaps and sweeping compounds. DiRubbo American Emery Ore (formerly DiRubbo & Ellis) mined emery at the Kingston mine near Croton. Output was used for general abrasive purposes. Emery produced at the DeLuca Emery mines near Croton and Peekskill was used as an aggregate in heavy duty, nonslip floors.

Sand and gravel for use in construction, paving, and fill was recovered from pits at Bedford Hills, Peekskill, and Carmel. All of the output was shipped to consumers by truck. Humus peat was produced near Armonk by Stone Age Humus Corp.

Wyoming.—Morton Salt Co. produced evaporated salt by open-pan at its Silver Springs plant. Some of the salt was sold in pressed blocks. Sawed and dressed architectural sandstone (bluestone) was produced by American Bluestone Co. at its Ambluco quarry near Portageville. Part of the output was used for hospital construction in New York City and for monuments at Arlington National Cemetery, Arlington, Va.

The Mineral Industry of North Carolina

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of North Carolina for collecting information on all minerals except fuels.

By William A. Beck,[1] Jasper L. Stuckey,[2] and Mildred E. Rivers[3]

MINERAL PRODUCTION in North Carolina set a new record of nearly $55 million, close to $5 million more than the previous peak year of 1961. In decreasing order of value, stone, sand and gravel, tungsten, feldspar, copper, mica, and clays were the principal minerals mined. North Carolina was first in the Nation in producing lithium minerals, feldspar, and sheet and scrap mica; second in olivine, tungsten, and crushed granite; and third in talc and pyrophyllite combined.

Metals accounted for only 9 percent of the total value, whereas in 1961 they accounted for 14 percent. Copper output decreased 39 percent in tonnage and 38 percent in value; tungsten production was

TABLE 1.—Mineral production in North Carolina[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Abrasive stones (millstones)	(2)	$3	(2)	$2
Clays[3] thousand short tons	2,603	1,669	2,731	1,782
Feldspar thousand long tons	252	2,477	245	2,373
Gem stones	(2)	6	(2)	2
Gold (recoverable content of ores, etc.) troy ounces	2,094	73	460	16
Iron ore (usable) long tons, gross weight	337	1	1,090	13
Lead (recoverable content of ores, etc.) short tons	318	66	219	40
Mica:				
Scrap thousand short tons	54	1,010	62	1,384
Sheet pounds	390,870	2,237	320,305	867
Sand and gravel thousand short tons	9,779	8,467	12,516	11,457
Silver (recoverable content of ores, etc.) troy ounces	169,742	157	100,439	109
Stone thousand short tons	15,921	25,262	19,308	29,533
Talc and pyrophyllite do	91	367	100	433
Values of items that cannot be disclosed: Asbestos, barite (1961), copper, kaolin, lithium minerals, olivine, and tungsten		8,329		6,586
Total		50,124		54,597

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Excludes kaolin, included with "Value of items that cannot be disclosed."

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about the same as in 1961, but decreased 13 percent in value. By-product lead, gold, and silver also were recovered in considerable quantities.

Lithium production was slightly less than in 1961. Stone output increased 21 percent in tonnage and 17 percent in value, and that of sand and gravel was up 28 percent in tonnage and 35 percent in value. Scrap mica increased both in tonnage and value, and sheet mica decreased in quantity and value because of the termination of government purchasing. Feldspar decreased in tonnage and value, and talc and pyrophyllite increased 10 percent in tonnage and 18 percent in value.

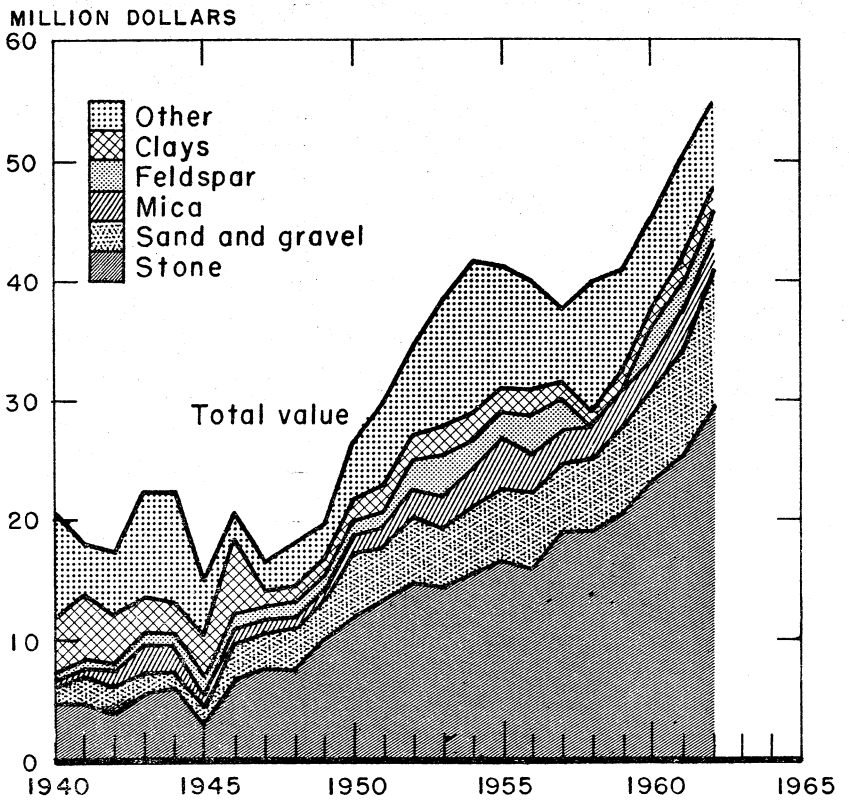

FIGURE 1.—Value of stone, sand and gravel, mica, feldspar, clays, and total value of mineral production in North Carolina 1940–62.

Employment and Injuries.—Table 2 shows 78 fewer operations and 715 fewer men working daily in 1962 than in 1961. However, sand and gravel mines increased by 11, and the number of men working daily increased by 189. The total man-hours worked in all operations decreased 10 percent; the largest decrease was in nonmetal mines in which the total man-hours was 31 percent below that of 1961. This was mainly attributed to the closing of a large number of small mica mines.

Injury experience was lower than in 1961; 5 fatalities were recorded, compared with only 3 in 1961; nonfatal injuries totaled 285 against 401 in 1961. Injuries per million man-hours were lower in all categories except nonmetal mines which increased by three.

TABLE 2.—Employment and injuries in the mineral industries

Year and industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:							
Nonmetal mines	186	2,689	222	4,792,401	1	110	23
Quarries and mills	82	2,097	205	3,563,312		148	42
Sand and gravel mines	128	901	222	1,695,863	1	38	23
Metal mines [1]	6	756	303	1,832,710	1	105	58
Total	402	6,443	226	11,884,286	3	401	34
1962: [2]							
Nonmetal mines	90	1,807	228	3,299,304	2	83	26
Quarries and mills	90	2,183	209	3,647,336	1	83	23
Sand and gravel mines	139	1,090	226	1,974,814		37	19
Metal mines [1]	5	648	335	1,738,897	2	82	49
Total	324	5,728	232	10,660,351	5	285	27

[1] Includes aluminum smelters.
[2] Preliminary figures.

Trends and Developments.—E. I. du Pont de Nemours & Co., Inc., withdrew from the silicon business, stating, "the capacity for producing semiconductor grade silicon in the United States is considerably in excess of the demand both now and in the foreseeable future." Du Pont had manufactured hyperpure semiconductor silicon for the electronics industry since 1952 at its Brevard plant.

The first major phase of the modernization and expansion of Aluminum Company of America, Badin, smelting operations was completed. The Tuckertown hydroelectric development, under construction since 1959, became operational in May. This new facility on the Yadkin River added 150 million kilowatt-hours annually to Badin's available supply of power. Construction of a new pot line for the Badin smelter began in October.

Lithium Corporation of America (LCA) announced it had acquired mining rights and purchase options to "one of the most important lithium bodies in the world." The deposits are located on about 470 acres, 5 miles from the company plant at Bessemer City. LCA considered the deposits to be high grade and largely amenable to opencut mining, and they have added more than 10 million tons of lithium ore to the Company's reserves, bringing its total North Carolina reserves to more than 20 million tons.

Copper Range Co. halted the operations of its wholly owned subsidiary, Appalachian Sulphides, Inc., in December. Appalachian Sulphides was acquired in May to continue exploration for additional copper ores at Ore Knob, Ashe County, to supply White Pine Copper Co., another Copper Range Co. subsidiary. An extensive exploration program conducted over several months did not find enough additional ore of an economic nature to warrant continued mining.

Tungsten Mining Corp., a subsidiary of Howe Sound Co., near Henderson, Vance County, closed its mining operation because the

continued drop in the price of tungsten made it impossible to operate the mine economically. The tungsten deposit was discovered in 1942, and operation continued until June 1958 when the mine was closed. The mine was reopened in May 1960, and has been operated continuously since then.

Plans for mining and processing huge phosphate deposits known to occur in Beaufort County, were progressing, according to officials of one of the companies leasing mining rights in the area. Texas Gulf Sulphur Co., and Pamlico Mining & Chemical Corp. were continuing active exploration in the area, and Magnet Cove Barium Corp., Houston, Tex. announced plans to begin exploration in the Belhaven area early in the spring of 1963.

Legislation and Government Programs.—The Government Mica Purchasing Depot under the General Services Administration (GSA) at Spruce Pine purchased mica until June 7, when the Domestic Mica Purchase Program was terminated. The program would have been terminated on June 30, had the program quantity limitation not been reached before that date. This quantity limitation was 25,000 short tons of hand-cobbed (crude) mica or its equivalent in trimmed mica (90 pounds of trimmed mica equals 1 short ton of hand-cobbed mica).

No Office of Mineral Exploration (OME) contracts were in force in 1962.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Millstones were produced in Rowan County from purchased materials.

Asbestos.—Powhatan Mining Co. mined amphibole asbestos near Burnsville in Yancey County. Production was slightly less than that in 1961.

Cement.—Ideal Cement Co. dedicated its new plant at Castle Hayne on July 6, when storage, packing, and bulk shipping facilities were completed. The manufacturing plant—the first in the State—was scheduled for completion by the middle of 1963. Cement was being shipped in from out of the State for storage and distribution in North Carolina.

Clays.—Total clay production increased 5 percent in tonnage and 7 percent in value. Kaolin increased 7 percent in tonnage and 9 percent in value, and miscellaneous clay increased 5 percent in tonnage and 7 percent in value. Harris Clay Co., Avery County, operating two mines, was the only kaolin producer. Miscellaneous clay was mined by 30 companies from 35 pits in 21 counties for manufacturing lightweight aggregate, brick, tile, and other clay products. Principal producers were Solite Corp., Sanford Brick Corp., Pine Hall Brick & Pipe Co., Boren Clay Products Co., and Pomona Pipe Products Co.

Feldspar.—The production of crude feldspar, including flotation concentrates, decreased 3 percent from that produced in 1961, and the value fell 4 percent. The unit value decreased from $9.83 per long ton in 1961 to $9.70. Flotation concentrates constituted 90 percent of the total crude production. International Minerals and Chemicals Corp. (Kona and Spruce Pine plants), The Feldspar Corp. (Spruce Pine

and Burnsville plants), and Lawson-United Feldspar and Minerals Co. (Minpro plant) mined alaskite and recovered feldspar concentrates in Mitchell and Yancey Counties. Foote Mineral Co. recovered byproduct feldspar at its lithium plant in Cleveland County. Crude lump feldspar from Mitchell, Yancey, and other counties comprised the balance of the production.

Sales of ground feldspar (including flotation concentrates) were 257,000 short tons valued at $2,863,000, a decrease of 4 percent in tonnage and an increase of 3 percent in value. The quantity of ground feldspar for glass uses decreased 12 percent and the value 3 percent. Pottery uses decreased 12 percent in tonnage and 11 percent in value, but that for enamel increased 164 percent in quantity and 83 percent in value.

Gem Stones.—Gem stones and gem material having an estimated value of $2,000 were collected in seven counties in 1962. Among the minerals reported were sapphires, smoky quartz, rutilated quartz, tourmalinated quartz, white topaz, pink corundum, rhodolite garnets, amethysts, and agates.

Lithium.—Foote Mineral Co. mined and processed spodumene at Kings Mountain, Cleveland County.

Mica.—Sheet mica decreased 18 percent in quantity and 61 percent in value, and scrap mica increased 15 percent in tonnage, and 37 percent in total value. Production of mica was reported from 78 mines in 10 counties, compared with 132 mines in 12 counties in 1961. A considerable tonnage could not be identified as to county or mine of origin. Mitchell County, with 34 mines, accounted for 43 percent of the total value of mica production; Avery, Cleveland, Macon, and Yancey accounted for 54 percent; and five or more counties (including value for "Undistributed") accounted for the remaining 3 percent. Leading producers of sheet mica were McBee Mining Co. (McBee mine), Mountain Mining Co. (Jimmy Cut mine), Sink Hole Miners (Sink Hole mine), Hawk Mining Co. (Long Cut mine), P & H Mining Co. (Gudger mine), and B & K Associates, Inc., (Bryson mine). Principal scrap producers were Deneen Mica Co., Harris Clay Co., Industrial

TABLE 3.—Sheet mica sold or used by producers, by counties

County	1961		1962	
	Pounds	Value	Pounds	Value
Ashe	(1)	(1)	(1)	(1)
Avery	2,790	$34,436	808	$9,854
Catawba	(1)	(1)		
Cleveland	88	875	(1)	(1)
Jackson	73	1,359		
Lincoln	(1)	(1)		
Macon	18,748	222,422	8,270	110,323
Mitchell	212,242	1,859,716	48,131	647,710
Rutherford	(1)	(1)	(1)	(1)
Stokes	1,813	12,107	(1)	(1)
Transylvania	(1)	(1)	(1)	(1)
Yancey	9,174	81,906	3,569	36,094
Undistributed	145,942	24,213	259,527	62,650
Total	390,870	2,237,034	320,305	866,631

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 4.—Mica sold or used by producers, by kinds

Kind		1961		1962	
		Quantity	Value	Quantity	Value
Sheet mica:					
Uncut punch and circle	pounds	247,959	$20,835	258,823	$22,810
Larger uncut mica	do	1,529	1,142	(1)	(1)
Full-trim purchased by GSA	do	141,382	2,215,057	(1)	(1)
Total sheet mica	do	390,870	2,237,034	[2]320,305	[2]866,631
Scrap mica	short tons	53.615	1,010,389	61,983	1,384,280
Grand total (sheet and scrap)	do	53,810	3,247,423	62,143	2,250,911

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Total sheet mica."
[2] Includes full-trimmed yield of hand-cobbed mica.

TABLE 5.—Ground mica sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Roofing	(1)	(1)	(1)	27,002	$783,760	$29.03
Well drilling	11,280	$306,881	$27.21	(1)	(1)	(1)
Paint	5,714	763,098	133.55	5,133	808,826	157.57
Rubber	3,290	404,309	122.89	(1)	(1)	(1)
Plastics	149	19,658	131.93	270	41,437	153.47
Wallpaper	202	23,948	118.55	194	28,242	145.58
Other uses [2]	28,640	914,018	31.91	19,866	1,279,285	64.40
Total	49,275	2,431,912	49.35	52,465	2,941,550	56.07

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[2] Includes joint cement, welding rods (1961), miscellaneous uses, and uses indicated by footnote 1.

Mica, Inc., Southern Mica Corp. of N.C., Kings Mountain Mica Co., Inc., Feldspar Corp., A & C Mica Co., and Hassett Mining Co. Output of ground mica was 6 percent higher, and the value increased 21 percent over that of 1961; 12 mica grinders were active during 1962.

Olivine.—Production of olivine increased in tonnage and value. Mines were operated in Jackson County by Harbison-Walker Refractories Co. and Balsam Gap Co., and in Yancey County by Wiseman Mining Co., Inc., and Georgia Talc Co.

Perlite.—Carolina Perlite Co., Inc., expanded perlite at Gold Hill from crude material shipped into North Carolina from Colorado. Quantity and value were nearly the same as in 1961.

Sand and Gravel.—The second mineral commodity in the State in both tonnage and value of production was sand and gravel. Commercial sand and gravel supplied 71 percent of the tonnage and 80 percent of the value, compared with 65 and 75 percent, respectively, in 1961. Commercial sand decreased 3 percent in tonnage and increased 1 percent in value, and Government-and-contractor sand increased 13 percent in tonnage and 17 percent in value. Commercial gravel increased 87 percent in tonnage and 70 percent in value, and Government-and-contractor gravel decreased 24 and 11 percent in tonnage and value

respectively. Sand and gravel was produced in 87 counties. Commercial sand and gravel was produced in 13 counties; gravel only was produced in 11 counties; and sand only was produced in 11 counties. Forty-six companies operated 67 pits in 39 counties compared with 51 pits in 33 counties in 1961. Government-and-contractor output of sand only occurred in 63 counties, and sand and gravel, in 7 others. Leading producers were Becker County Sand and Gravel Co., lessees of B. V. Hedrick Gravel & Sand Co., W. R. Bonsal Co., Inc., and the State highway department.

Stone.—Output of stone, the principal mineral product of the State, increased 21 percent in tonnage and 17 percent in value. Crushed stone production was up 21 percent in tonnage and 19 percent in value and dimension stone increased 7 percent in quantity, but decreased 12 percent in value.

Crushed traprock production increased 20 percent in tonnage and 7 percent in value, crushed granite increased 23 percent in tonnage and 23 percent in value, and crushed limestone increased 14 percent in both tonnage and value. Crushed sandstone increased 9 percent in tonnage and 11 percent in value, but crushed marble production increased 25-fold in volume and 325 percent in value because of a new operation in the State. Production of dimension slate was unchanged from 1961, dimension marble increased 2 percent in quantity but decreased 6 percent in value, and dimension granite was 9 percent greater in tonnage and 12 percent lower in value. Byproduct quartz was recovered from feldspar flotation plants in Mitchell County.

TABLE 6.—Sand and gravel sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Alexander	44,500	$14,685	45,530	$15,962
Alleghany			76,600	63,800
Ashe	(1)	(1)	111,194	131,341
Avery	80,418	74,781		
Bertie	3,000	875	6,334	3,800
Bladen	128,000	74,960	95,100	68,620
Brunswick	21,000	11,340	24,000	14,400
Buncombe	715,842	767,084	928,235	982,791
Burke	35,600	21,675	277,262	208,400
Cabarrus	105,520	107,458	42,325	18,265
Camden	6,000	3,240	12,500	7,500
Carteret	4,000	1,960	5,000	2,500
Caswell	20,500	20,500	16,400	16,400
Catawba	63,810	22,003	72,686	26,564
Cherokee	22,725	27,900	(1)	(1)
Chowan	2,400	720	1,200	720
Columbus	107,000	62,980	174,800	106,600
Currituck	58,300	22,770	44,000	26,400
Dare	4,640	2,506		
Davidson	205,000	102,500	195,500	97,750
Davie	70,000	42,000	64,000	38,400
Duplin	10,225	5,587	12,175	7,350
Edgecombe	26,200	17,400	65,200	44,920
Forsyth	110,000	66,000	84,100	51,180
Franklin	9,800	4,700	10,000	5,000
Gaston	43,104	17,241	62,774	25,109
Gates	12,500	6,750	38,000	22,800
Granville	7,070	5,302	7,200	5,325
Greene	87,300	42,777	72,400	36,200
Guilford	5,750	5,750	6,700	6,700
Halifax	8,400	4,536	(1)	(1)
Hertford	77,460	39,707	102,291	61,37

See footnotes at end of table.

TABLE 6.—Sand and gravel sold or used by producers, by counties—Continued

County	1961		1962	
	Short tons	Value	Short tons	Value
Hoke	65,112	$42,760	43,071	$25,840
Hyde	1,800	540	1,800	450
Iredell	(1)	(1)	97,547	35,243
Johnston	68,271	80,421	48,500	45,650
Jones	19,668	10,576	25,976	12,988
Lee	85,644	46,248	191,290	132,770
Lincoln	45,330	18,132	66,970	26,788
Madison	5,000	3,500		
Martin	1,800	540		
Montgomery	96,870	41,000	78,000	28,410
Moore	390,081	304,993	545,748	365,089
New Hanover	11,089	5,824	8,000	4,800
Onslow	9,000	4,860	11,000	6,600
Pamlico	3,000	1,470	1,000	500
Pasquotank	15,000	8,100	10,000	6,000
Pender	9,000	4,860	11,000	6,600
Perquimans	4,000	2,160	14,100	8,460
Person	5,800	4,350	6,000	4,500
Pitt	128,460	77,897	136,138	82,579
Polk	76,000	41,700	(1)	(1)
Richmond	55,000	20,200	76,000	29,850
Robeson	169,000	97,180	374,500	403,100
Rockingham	2,527	2,527	1,240	1,240
Rowan	65,000	32,500	65,000	32,500
Sampson	15,000	8,100	148,000	115,800
Scotland	13,000	4,550	14,500	5,075
Stanly	55,735	82,102	4,500	4,500
Stokes	106,000	63,600	78,000	46,800
Surry	18,715	10,100	18,880	28,320
Transylvania	486	460	(1)	(1)
Tyrrell	1,800	540		
Union	8,000	6,000	20,000	15,000
Vance			5,000	2,500
Wake	3,500	2,100	5,162	3,613
Washington	3,400	1,020	2,500	1,500
Watauga	(1)	(1)	128,674	122,174
Wayne	96,623	63,370	(1)	(1)
Wilkes	(1)	(1)	97,300	79,300
Wilson	54,336	34,925	90,005	53,210
Yadkin	11,445	17,167	8,760	13,140
Yancey	(1)	(1)	365,491	259,689
Undistributed [2]	5,962,469	5,723,165	7,062,566	7,350,538
Total	9,779,025	8,467,224	12,515,724	11,457,283

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes Anson, Beaufort, Caldwell, Cleveland, Craven, Cumberland, Graham (1962), Harnett, Haywood, Henderson (1962), Jackson (1962), Lenoir, Macon (1962), McDowell, Mecklenburg, Mitchell (1962), Northampton, Rutherford Counties, and counties indicated by footnote 1.

Stone was quarried in 44 counties—granite in 29, traprock in 14, limestone in 6, slate in 2 (Davidson and Montgomery), marble in 1 (Cherokee), and quartz in 1 (Mitchell). Commercial stone, excluding quartz, was produced by 23 operators from 76 quarries—54 granite, 11 traprock, 7 limestone, and 2 each of slate and marble. The State highway department crushed stone from eight granite, one limestone, and five traprock quarries. Leading crushed stone producers were Superior Stone Co., a division of Martin Marietta Corp. (granite, traprock, and limestone); W. E. Graham & Sons, a division of Vulcan Materials Co. (granite); and Nello L. Teer Co. (granite, traprock, and limestone). Principal producers of dimension stone were North Carolina Granite Corp., Harris Granite Quarries, and Columbia Marble Co.

TABLE 7.—Sand and gravel sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Paving	3,457,169	$2,058,076	$0.60	2,973,431	$1,755,660	$0.59
Structural	2,080,843	1,501,197	.72	2,134,329	1,686,935	.79
Fill	384,823	239,350	.62	425,086	265,621	.62
Railroad ballast	(1)	(1)	(1)	127,435	109,572	.86
Other [2]	32,469	28,351	.87	532,084	273,854	.51
Gravel:						
Paving	2,098,989	2,018,907	.96	4,215,204	4,078,399	.97
Structural	1,304,530	1,959,837	1.50	1,540,826	2,315,079	1.50
Fill	1,838	1,838	1.00	20,000	18,800	.94
Other [3]	418,364	659,668	1.58	547,329	953,363	1.74
Total sand and gravel	9,779,025	8,467,224	.87	12,515,724	11,457,283	.92

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other sand."
[2] Includes sand for filtration, blast, other uses, and uses indicated by footnote 1.
[3] Includes railroad ballast gravel.

TABLE 8.—Crushed granite sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Buncombe	6,210	$12,400	(1)	(1)
Cabarrus	59,760	59,760	(1)	(1)
Cherokee	13,400	33,600	23,102	$57,755
Macon			38,049	76,099
Orange	33,458	50,187	50,865	76,297
Randolph	172,312	266,786	(1)	(1)
Transylvania	120,000	150,000	(1)	(1)
Undistributed [2]	10,792,832	15,814,030	13,611,071	19,881,634
Total	11,197,972	16,386,763	13,723,087	20,091,785

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes Alamance, Caswell, Catawba, Edgecombe (1961), Forsyth, Gaston, Guilford, Iredell, Jackson (1961), Lincoln, Mecklenburg, Nash (1962), Northampton (1962), Pitt, Rockingham, Rowan, Stokes (1962), Surry, Swain, Vance, Wake, Wilkes (1962), Wilson, Yadkin Counties, and counties indicated by footnote 1.

Talc and Pyrophyllite.—Combined production of crude talc and pyrophyllite increased 10 percent in tonnage and 18 percent in value. Ground talc and pyrophyllite increased 10 percent in tonnage and 9 percent in value. Sawed talc (crayons) remained the same in volume, but increased 5 percent in value. Ground talc was sold principally for textile use and toilet preparations. Ground pyrophyllite was used principally in ceramics, insecticides, refractories, and rubber products. Talc was mined in Cherokee County, and pyrophyllite was mined in Alamance, Moore, and Orange Counties.

Vermiculite.—Zonolite Co. operated an exfoliating plant at High Point, using crude vermiculite shipped into the State.

METALS

Gold, Silver, Copper, and Lead.—Copper production decreased 39 percent in tonnage and 38 percent in value. Appalachian Sulphides, Inc., mined and concentrated sulfide ore from the Ore Knob mine at West Jefferson, and Tungsten Mining Corp. recovered copper and lead from flotation tailings from its tungsten mill in Vance County. Gold and silver were recovered from the smelting of concentrates of both companies. Appalachian Sulphides, Inc., having depleted its reserves, ceased operations in December. Tungsten Mining Corp. announced the shut down of its mine early in 1963 because it could not operate economically at the low price of tungsten.

Iron Ore.—Cranberry Magnetite Corp. shipped a small tonnage of magnetite from its Cranberry mine for use as a heavy aggregate in concrete.

Silicon.—High-purity silicon was produced at Brevard by E. I. du Pont de Nemours & Co., Inc., which announced it would withdraw from the silicon business in March 1963.

Tungsten.—The Hamme mine and mill of Tungsten Mining Corp., a Division of Howe Sound Co., near Henderson in Vance County were in operation the entire year, but announced their intention to cease operation early in 1963.

REVIEW BY COUNTIES

Ninety-five of the 100 counties in North Carolina reported mineral production; Vance, Cleveland, Mitchell, Guilford, and Forsyth were the leading counties. In addition to the detailed county production listed in table 9, considerable quantities of crude feldspar and sheet mica—of undetermined county origin—were produced.

Alamance.—Superior Stone Co., a division of Martin Marietta Corp. (Burlington and Mebane quarries), and North Carolina State Highway and Public Works Commission (Bason quarry) crushed granite for concrete and roads. Boren & Harvey, Inc., mined pyrophyllite for refractory and ceramic uses at the Snow Camp mine. Hanford Brick Co., Inc., mined miscellaneous clay for heavy clay products. Allison Rock & Novelties collected a small quantity of gem stones (pyrophyllite).

Alexander.—The State highway commission mined paving sand. Ruth Stanley collected a small quantity of gem stones (rutilated, smoky, and tourmalinated quartz and white topaz).

Alleghany.—Carl W. Clement Construction Co., Inc., mined paving gravel at the Allegheny mine. Ararat Products Co. crushed traprock for concrete and roads.

TABLE 9.—Value of mineral production in North Carolina, by counties [1]

County	1961	1962	Minerals produced in 1962 in order of value
Alamance	(2)	(2)	Granite, pyrophyllite, miscellaneous clay, gem stones.
Alexander	$16,795	$16,017	Sand and gravel, gem stones.
Alleghany	(2)	(2)	Sand and gravel, traprock.
Anson	(2)	(2)	Do.
Ashe	(2)	(2)	Copper, sand and gravel, gold, silver, mica.
Avery	(2)	(2)	Kaolin, mica, iron ore.
Beaufort	(2)	(2)	Sand and gravel.
Bertie	875	3,800	Do.
Bladen	74,960	68,620	Do.
Brunswick	11,340	14,400	Do.
Buncombe	779,484	(2)	Sand and gravel, granite.
Burke	21,785	208,400	Sand and gravel.
Cabarrus	(2)	(2)	Traprock, granite, sand and gravel.
Caldwell	(2)	(2)	Sand and gravel.
Camden	3,240	7,500	Do.
Carteret	1,960	2,500	Do.
Caswell	(2)	(2)	Granite, sand and gravel.
Catawba	(2)	(2)	Granite, miscellaneous clay, sand and gravel.
Chatham	371,996	448,812	Miscellaneous clay, traprock.
Cherokee	(2)	(2)	Marble, sand and gravel, granite, talc.
Chowan	720	720	Sand and gravel.
Clay	----------	2,100	Gem stones.
Cleveland	(2)	(2)	Lithium minerals, limestone, traprock, mica, sand and gravel, feldspar.
Columbus	62,980	106,600	Sand and gravel.
Craven	(2)	(2)	Limestone, sand and gravel.
Cumberland	(2)	(2)	Sand and gravel, miscellaneous clay.
Currituck	22,770	26,400	Sand and gravel.
Dare	2,506	----------	
Davidson	(2)	(2)	Traprock, sand and gravel, slate, miscellaneous clay gem stones.
Davie	42,000	38,400	Sand and gravel.
Duplin	5,587	7,350	Do.
Durham	(2)	(2)	Traprock, miscellaneous clay
Edgecombe	(2)	44,920	Sand and gravel.
Forsyth	(2)	(2)	Granite, sand and gravel.
Franklin	4,700	5,000	Sand and gravel.
Gaston	(2)	(2)	Granite, sand and gravel, miscellaneous clay.
Gates	6,750	22,800	Sand and gravel.
Graham	----------	(2)	Do.
Granville	5,522	5,325	Do.
Greene	42,777	36,200	Do.
Guilford	(2)	(2)	Granite, traprock, miscellaneous clay, sand and gravel.
Halifax	(2)	(2)	Sand and gravel, miscellaneous clay.
Harnett	(2)	(2)	Do.
Haywood	(2)	(2)	Sand and gravel.
Henderson	(2)	(2)	Limestone, sand and gravel, miscellaneous clay.
Hertford	39,707	61,370	Sand and gravel.
Hoke	42,760	25,840	Do.
Hyde	540	450	Do.
Iredell	(2)	(2)	Granite, sand and gravel.
Jackson	(2)	(2)	Sand and gravel, olivine, mica.
Johnston	(2)	(2)	Traprock, sand and gravel, miscellaneous clay.
Jones	10,576	12,988	Sand and gravel.
Lee	(2)	(2)	Miscellaneous clay, sand and gravel.
Lenoir	(2)	(2)	Sand and gravel.
Lincoln	(2)	(2)	Granite, sand and gravel.
Macon	296,471	354,523	Mica, sand and gravel, granite, gem stones.
Madison	(2)	----------	
Martin	540	----------	
McDowell	(2)	(2)	Sand and gravel, limestone.
Mecklenburg	(2)	(2)	Granite, sand and gravel.
Mitchell	(2)	3,387,677	Feldspar, mica, sandstone, sand and gravel, gem stones.
Montgomery	(2)	(2)	Sand and gravel, slate, miscellaneous clay.
Moore	(2)	(2)	Sand and gravel, pyrophyllite, miscellaneous clay.
Nash	----------	(2)	Granite.
New Hanover	5,824	4,800	Sand and gravel.
Northampton	(2)	(2)	Sand and gravel, granite.
Onslow	(2)	(2)	Limestone, sand and gravel.
Orange	(2)	(2)	Pyrophyllite, granite, traprock.
Pamlico	1,470	500	Sand and gravel.
Pasquotank	8,100	6,000	Do.
Pender	4,860	6,600	Do.
Perquimans	2,160	8,460	Do.
Person	4,400	4,500	Do.
Pitt	(2)	(2)	Granite, sand and gravel.
Polk	41,700	(2)	Sand and gravel.
Randolph	266,786	(2)	Granite.

See footnotes at end of table.

TABLE 9.—Value of mineral production in North Carolina, by counties [1]—Con.

County	1961	1962	Minerals produced in 1962 in order of value
Richmond	$20,200	$29,850	Sand and gravel.
Robeson	97,180	403,100	Do.
Rockingham	(2)	(2)	Granite, miscellaneous clay, traprock, sand and gravel.
Rowan	(2)	(2)	Granite, miscellaneous clay, sand and gravel.
Rutherford	(2)	(2)	Sand and gravel, mica.
Sampson	(2)	138,180	Sand and gravel, miscellaneous clay.
Scotland	4,550	5,075	Sand and gravel.
Stanly	389,604	348,072	Miscellaneous clay, traprock, sand and gravel.
Stokes	(2)	(2)	Granite, miscellaneous clay, sand and gravel, mica.
Surry	(2)	(2)	Granite, traprock, sand and gravel, gem stones.
Swain	(2)	(2)	Limestone, granite, feldspar.
Transylvania	154,333	(2)	Granite, sand and gravel, mica.
Tyrrell	540		
Union	(2)	(2)	Traprock, miscellaneous clay, sand and gravel.
Vance	(2)	(2)	Tungsten, granite, silver, lead, copper, sand and gravel, gold.
Wake	(2)	(2)	Granite, sand and gravel.
Washington	1,020	1,500	Sand and gravel.
Watauga	(2)	122,174	Do.
Wayne	63,380	(2)	Do.
Wilkes	(2)	(2)	Granite, sand and gravel.
Wilson	(2)	(2)	Do.
Yadkin	(2)	(2)	Do.
Yancey	(2)	(2)	Mica, sand and gravel, olivine, asbestos, feldspar.
Undistributed	47,188,552	48,609,477	
Total	50,124,000	54,597,000	

[1] Warren County is not listed because no production was reported.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Anson.—Lessees of B. V. Hedrick Gravel & Sand Co. (Lilesville mine), W. R. Bonsal Co., Inc. (Bonsal mine), and the State highway commission mined sand and gravel for structural, paving, railroad ballast, and miscellaneous uses. The State highway commission crushed traprock for concrete and roads at the Sugartown and Hendley quarries.

Ashe.—Appalachian Sulphides, Inc., recovered copper, gold, and silver at the Ore Knob mine; during the year the mine was closed because of depletion of the ore bodies. Maymead Lime Co., Inc. (Longhope mine), mined paving gravel. Ernest Aldridge (Duncan mine) and Joe L. Snyder (Harding mine) produced sheet mica.

Avery.—Cranberry Magnetite Corp. shipped a small quantity of magnetite from the Cranberry mine. Nine mica mines were active. The leading producers of sheet mica were T. J. Greene (Ground Hog mine), Joe L. Snyder (Birch and Abe Beam mines) and Bill Burleson (Charlie Ridge mine). Harris Clay Co. (Gushers Knob and Kaolin mines) was the only producer of scrap mica. English Mica Co. and Harris Clay Co. ground mica for roofing, paint, rubber, wallpaper, plastic, and miscellaneous uses. Harris Clay Co. mined kaolin at the Gusher Knob and Kaolin mines for whiteware, refractories, organic plastics, and other uses.

Beaufort.—J. D. McCotter, Inc. (Washington mine), and the State highway commission mined structural and paving sand.

Bertie.—The State highway commission mined 6,300 tons of paving sand.

Bladen.—The State highway commission mined 95,000 tons of sand and gravel for paving and fill uses.

Brunswick.—The State highway commission mined 24,000 tons of paving sand.

Buncombe.—Six operators mined sand and gravel for structural, paving, and fill uses at seven mines. The leading producers were Grove Stone & Sand Branch (Grove mine) and Western Stone, Inc. W. E. Graham & Sons, a division of Vulcan Materials Co., crushed granite for concrete and roads at the Enka quarry. Asheville Mica Co. ground mica for rubber and joint cement uses.

Burke.—A. R. Thompson, contractor, A. P. Causby Sand & Stone Co., Carl W. Clement Construction Co., Inc., and the State highway commission mined sand and gravel for structural and paving uses. Great Lakes Carbon Corp. manufactured carbon and graphite products at the Morgantown plant.

Cabarrus.—Young Stone Co. crushed traprock for concrete, roads, and other uses at the Gold Hill quarry. Lee White Gravel Pit (Concord quarry) and the State highway commission crushed granite for concrete and roads. R. L. Holt Co. (Concord mine) and the State highway commission mined sand and gravel for paving use.

Caldwell.—Carl W. Clement Construction Co., Inc. (Caldwell mine), Miller Brothers Co., and the State highway commission mined sand and gravel for structural and paving uses.

Camden.—The State highway commission mined 12,500 tons of paving sand.

Carteret.—About 5,000 tons of paving sand was mined by the State highway commission.

Caswell.—W. E. Graham & Sons (Shelton quarry) and the State highway commission (Ivy Bluff quarry) produced granite for riprap, concrete, roads, and railroad ballast uses. The State highway commission mined 16,400 tons of paving sand.

Catawba.—Superior Stone Co. (Hickory quarry) crushed granite for concrete and roads. Statesville Brick Co. (Statesville mine) mined miscellaneous clay for heavy clay products. The State highway commission mined 73,000 tons of paving sand.

Chatham.—Cherokee Brick Co. of North Carolina (Brickhaven mine), Boren Clay Products Co. (Gulf mine), Pomona Terra Cotta Co., and Chatham Brick & Tile Co., Inc., mined miscellaneous clay for heavy clay products. The State highway commission crushed traprock for concrete and roads at the Goldston quarry.

Cherokee.—Columbia Marble Co. (Pleasant Valley quarry) quarried dimension marble for rough interior; sawed and cut interior building stone; and cut, dressed monumental stone. Universal Materials Corp. and Columbia Marble Co. crushed marble for terrazzo and other uses. Macon Construction Co. mined paving gravel. Hitchcock Corp. (Nancy Jordan mine) mined talc for textiles, toilet preparations, and other uses. The State highway commission crushed granite for concrete and roads at the Carringer quarry.

Chowan.—The State highway commission mined 1,200 tons of paving sand.

Clay.—Arvil Long and Fred O. Scruggs collected a quantity of gem stones (sapphire and pink corundum).

Cleveland.—Cleveland County ranked second in value of mineral production. Superior Stone Co. crushed limestone at the Kings Moun-

tain quarry and crushed traprock at the Kings Mountain No. 2 quarry for concrete and roads. Shelby Sand & Stone Inc. (First Broad River mine) and the State highway commission mined sand for structural, paving, fill, and other uses. Seven mica mines were active. Joe L. Snyder (Ledford and Blalock No. 2 mines) and W. H. Humphries (Joe Humphries mine) produced sheet mica. Industrial Mica, Inc., Kings Mountain Mica Co., Inc. (Moss and Patterson mines), and Foote Mineral Co. (Kings Mountain mine) produced scrap mica. Foote Mineral Co. at Kings Mountain mined and processed lithium minerals and also produced a small quantity of byproduct feldspar for glass.

Columbus.—Riegel Carolina Corp. recovered quicklime at the Acme Paper Mill. The State highway commission mined 174,800 tons of paving and fill sand.

Craven.—Superior Stone Co. (New Bern quarry) and Nello L. Teer Co. crushed limestone for concrete and roads. Southern Sand Co., Inc. (New Bern mine), and the State highway commission mined structural and paving sand.

Cumberland.—Becker County Sand & Gravel Co. (Fayetteville mine) and the State highway commission mined sand and gravel for structural, paving, and fill uses. Ideal Brick Co. (Linden mine) mined miscellaneous clay for heavy clay products.

Currituck.—Approximately 44,000 tons of paving sand was mined by the State highway commission.

Davidson.—Superior Stone Co. crushed traprock at the Lexington quarry for concrete and roads. Jacob's Creek Stone Co., Inc. (Flagstone quarry), quarried dimension slate for structural millstock and flagging. Cunningham Brick Co. (Thomasville mine) mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand and gravel. Allison Rock & Novelties collected a small quantity of gem stones (siderite).

Davie.—The State highway commission mined 64,000 tons of paving sand.

Duplin.—James W. Kelly (Wallace mine) and the State highway commission mined structural, paving, and fill sand.

Durham.—Nello L. Teer Co. produced traprock for riprap, concrete, and roads. Borden Brick & Tile Co. (Durham mine) and Tri-Angle Brick Co. mined miscellaneous clay for heavy clay products.

Edgecombe.—Tar River Sand & Gravel (Whitehurst mine) and the State highway commission mined structural and paving sand.

Forsyth.—The county ranked fifth in value of mineral production. W. E. Graham & Sons produced granite for riprap, concrete, and roads at the North, Piedmont, No. 421, and South Fork quarries. Paul Miller and the State highway commission mined structural and paving sand.

Franklin.—The State highway commission mined 10,000 tons of paving sand.

Gaston.—Superior Stone Co. crushed granite for concrete and roads at the Gaston quarry. Kendrick Brick & Tile Co. (Mount Holly mine) mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand.

Gates.—About 38,000 tons of paving sand was produced by the State highway commission.

Graham.—Rock Products, Inc. (Colvard mine), and Nantahala Talc & Limestone Co. mined paving gravel.

Granville.—The State highway commission produced 7,200 tons of paving sand.

Greene.—The State highway commission mined 72,400 tons of paving and fill sand.

Guilford.—The county ranked fourth in value of mineral production. Superior Stone Co. (Jamestown, Pomona, Buchanan, and McLeansville quarries) and W. E. Graham & Sons (Stokesdale quarry) crushed granite for concrete, roads, and railroad ballast. Superior Stone Co. crushed traprock for concrete and roads at the Hicone quarry. Boren Clay products Co. mined miscellaneous clay for heavy clay products at the Pleasant Garden mine. The State highway commission mined paving sand. Zonolite Co. exfoliated vermiculite at the High Point plant.

Halifax.—Superior Stone Co. (Weldon mine) and the State highway commission mined sand and gravel for structural and paving uses. Nash Brick Co., Inc. (Ita and Page mines), mined miscellaneous clay for heavy clay products. Albemarle Paper Manufacturing Co. recovered quicklime at the Roanoke Rapids mill.

Harnett.—Becker County Sand & Gravel Co. (Senter mine), Nello L. Teer Co. (Erwin mine), and the State highway commission mined sand and gravel for structural, paving, railroad ballast, fill, and other uses. Norwood Brick Co. mined miscellaneous clay for heavy clay products at the Lillington mine.

Haywood.—Carl W. Clement Construction Co., Inc. (Haywood mine), and A. M. Sale, Inc. (Waynesville mine), mined paving sand and gravel. Champion Papers, Inc., recovered quicklime at the Canton mill.

Henderson.—Cogdill Limestone Co. and Fletcher Limestone Co., Inc., crushed limestone for concrete and roads. A. R. Thompson, Contractor, Inc., mined paving gravel. The Fletcher Brick Co., Inc., mined miscellaneous clay for heavy clay products.

Hertford.—The State highway commission produced 103,000 tons of paving sand.

Hoke.—About 43,000 tons of paving sand was mined by the State highway commission.

Hyde.—The State highway commission mined 1,800 tons of paving sand.

Iredell.—Superior Stone Co. (Statesville quarry) and the State highway commission (Iredell quarry) produced granite for riprap, concrete, and roads. The State highway commission mined paving sand.

Jackson.—Harbison-Walker Refractories Co. (Addie mine) and Balsam Gap Co. (Balsam Gap mine) mined olivine for refractories. Rock Products, Inc. (Caney Fork and Sylva Gravel mines), mined paving gravel. Sylva, Inc. (Bumgarner mine), was the only mica producer.

Johnston.—Nello L. Teer Co. (Princeton quarry) crushed traprock for concrete and roads. Crumpler Brick & Tile Co. mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand.

Jones.—The State highway commission mined 26,000 tons of paving sand.

Lee.—Sanford Brick & Tile Co., Inc., Borden Brick & Tile Co., Inc., and Lee Brick & Tile Co. mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand and gravel.

Lenoir.—Barrus Construction Co. (Kinston mine) and the State highway commission mined sand and gravel for structural, paving, fill, and other uses.

Lincoln.—Superior Stone Co. (Denver quarry) and Duke Power Co. (Cowans Ford quarry) crushed granite for concrete and roads. The State highway commission mined paving sand.

Macon.—Eight mines produced mica. The leading producers of sheet mica were B-K Associates, Inc. (Bryson mine), Allman Cove Mining Co. (Rock Cut mine), Roy H. Fouts (Allman Cove mine), and P.E.L. Mining Co. (Chalk Hill mine). A & C Mica Co. (Sheppard Knob mine) was the leading producer of scrap mica. Franklin Mineral Products Co. ground mica for paint, rubber, wallpaper, plastic, and other uses. Macon Construction Co. (Sparks & McKinney mine) mined paving gravel. Franklin Construction Co. (Tubb Mill quarry) crushed granite for concrete and roads. Fred O. Scruggs, Andrew Reid, and Robert A. Campbell collected a quantity of gem stones (amethyst, rhodolite, and corundum).

McDowell.—Becker County Sand & Gravel Co., E. P. Boyd, and the State highway commission mined structural and paving sand and gravel. The State highway commission crushed limestone for concrete and roads at the Woodlawn quarry.

Mecklenburg.—Superior Stone Co. crushed granite for concrete and roads at the Charlotte, Pineville, and Davidson quarries. H. D. Bartlett Sand Co. (Charlotte mine) mined structural sand.

Mitchell.—The county ranked third in value of mineral production. Thirty-four mines produced mica 20 of which produced sheet mica only (punch, full-trimmed and/or hand-cobbed), 6 produced scrap mica only, and 8 produced sheet and scrap mica. The leading producers of sheet mica were McBee Mining Co. (McBee mine), Mountain Mining Co. (Jimmy Cut mine), and Sink Hole Miners (Sink Hole mine). The leading producers of scrap mica were Southern Mica Co. of North Carolina (Bailey mine), Deneen Mica Co. (Sparks Strip mine), and The Feldspar Corp. (Poteat and Wiseman mines). Five companies ground mica for roofing, wallpaper, well drilling, paint, rubber, plastic, and other uses; the leading producer was Carolina-Southern Mining Co., Inc. Six operators produced feldspar from nine mines; the leading producers were International Minerals & Chemical Corp. (Hawkins and Kona mines) and The Feldspar Corp. (Poteat, Wiseman, and Sullins mines). Ground feldspar for enamel, tile, glass, and pottery uses was produced by International Minerals & Chemical Corp., The Feldspar Corp., and Lawson United Feldspar & Minerals Co. Crushed sandstone (quartz) was recovered from feldspar milling. Crabtree Stone & Gravel Co. (Crabtree mine) and E. P. Boyd (Roan Mountain mine) mined paving sand and gravel. Allison Rock & Novelties and Clearwater Novelty collected a small quantity of gem stones (uranium, lepidolite, and autunite).

Montgomery.—Harrison Sand Pit, J. M. Reid Sand Pit, and the State highway commission mined structural and paving sand. Jacob's Creek Stone Co., Inc. (Edenboro quarry), quarried dimension slate for structural millstock and flagging. Mt. Gilead Brick Co. mined miscellaneous clay for heavy clay products.

Moore.—Standard Mineral Co., Inc. (Underground mine), and General Minerals Co. (Glendon mine) mined pyrophyllite for ceramics, insecticides, paint, rubber, refractory, and plastics uses. Five operators mined sand and gravel for structural, paving, fill, and other uses; the leading producers were Pleasants Sand & Supply Co. and the State highway commission. Ceramic Minerals, Inc. (Robbins mine) and T & H Clay Co., Inc. (Hancock mine), mined miscellaneous clay for heavy clay products.

Nash.—Nello L. Teer Co. crushed granite for concrete, roads, and stone sand at the Rocky Mount quarry.

New Hanover.—The State highway commission mined 8,000 tons of paving sand.

Northampton.—Superior Stone Co. (Garysburg mine) and the State highway commission mined structural and paving sand and gravel. Nello L. Teer Co. crushed granite for concrete and roads at the King quarry.

Onslow.—Superior Stone Co. crushed limestone for concrete and roads at the Belgrade quarry. The State highway commission mined 11,000 tons of paving sand.

Orange.—Piedmont Minerals Co., Inc. (Hillsboro mine), mined pyrophyllite for ceramics and refractory purposes. Superior Stone Co. crushed traprock at the Eno quarry for concrete and roads. Duke University quarried dimension granite at the Hillsboro quarry for rough construction use. The State highway commission crushed granite for concrete and roads at the Bacon quarry.

Pamlico.—The State highway commission produced 1,000 tons of paving sand.

Pasquotank.—About 10,000 tons of paving sand was produced by the State highway commission.

Pender.—The State highway commission mined 11,000 tons of paving sand.

Perquimans.—A total of 14,100 tons of paving sand was mined by the State highway commission.

Person.—The State highway commission mined 6,000 tons of paving sand.

Pitt.—Superior Stone Co. crushed granite at the Franklin quarry for concrete and roads. Concrete Products Co. (Greenville mine), White Concrete Co., Inc. (Munford mine), and the State highway commission mined structural and paving sand.

Polk.—A. R. Thompson, Contractor, Inc., mined paving gravel.

Randolph.—Superior Stone Co. (Ashboro quarry) and the State highway commission (Parks Cross Road quarry) crushed granite for concrete and roads.

Richmond.—The State highway commission mined 76,000 tons of paving sand and gravel.

Robeson.—The State highway commission mined 375,000 tons of sand and gravel for paving and fill uses.

Rockingham.—Superior Stone Co. (Reidsville quarry) and the State highway commission (Newman quarry) crushed granite for concrete and roads. Virginia Solite Corp. (Leaksville mine) and Webster Brick Co., Inc. (Draper mine), mined miscellaneous clay for lightweight aggregate and heavy clay products. M. Lester Hall crushed granite for concrete and roads at the King's quarry. The State highway commission mined paving sand.

Rowan.—Six quarries produced dimension granite for use as rubble, dressed architectural stone, rough and dressed monumental stone, curbing and flagging, and paving blocks. The leading producer was Harris Granite Quarries Co. (Collins, Balfour, and Shuping quarries). Superior Stone Co. crushed granite for concrete and roads at the Woodleaf and Kannapolis quarries. Isenhour Brick & Tile Co. (East Spencer mine) and Carolina Tuff-Lite Corp. (Tuff-Lite mine) mined miscellaneous clay for heavy clay products and lightweight aggregates. Carolina Perlite Co., Inc., expanded perlite at the Gold Hill plant. Gardner Granite Works produced millstones. The State highway commission mined paving sand.

Rutherford.—A. R. Thompson, Contractor, Inc., and the State highway commission mined paving sand and gravel. Grady Campbell produced a small quantity of sheet mica at the McFarland mine.

Sampson.—Williams Sand & Gravel Co. and the State highway commission mined structural and paving sand and gravel. Crumpler Brick & Tile Co., Inc., Sampson Brick Co., Inc., and Patterson Brick Co. mined miscellaneous clay for heavy clay products.

Scotland.—The State highway commission mined 15,000 tons of paving sand.

Stanly.—Carolina Solite Corp. (Aquadale mine), Stanley Shale Products, Inc. (Norwood mine), and Yadkin Brick Yards, Inc. (Yadkin mine), mined miscellaneous clay for lightweight aggregates and heavy clay products. The State highway commission crushed traprock for concrete and roads at the McManus quarry and also mined paving sand. Aluminum Company of America produced primary aluminum at its smelter at Badin.

Stokes.—W. E. Graham & Sons crushed granite for concrete and roads at the Sandy Ridge quarry. P.E.L. Mining Co. (Spencer mine), M & L Mining Co. (Mabe mine), and Ernest Aldridge (Steel mine) produced sheet and scrap mica. Pine Hall Brick & Pipe Co. (No. 1 mine) mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand.

Surry.—North Carolina Granite Corp. (Mount Airy quarry) quarried dimension granite for rubble, rough and dressed construction stone, rough and dressed architectural stone, rough and dressed monumental stone, curbing, flagging, and paving blocks. W. E. Graham & Sons (Pilot Mountain, Elkins, and Mount Airy quarries) and North Carolina Granite Corp. produced granite for riprap, concrete, roads, and poultry grit. Ararat Products Co. (Surry quarry) crushed traprock for concrete and roads. The State highway commission mined paving sand. Ruth P. Stanley and James L. Cumbie collected a small quantity of gem stones (star sapphire, blue corundum, quartz crystals, and agate).

Swain.—Nantahala Talc & Limestone Co. (Hewitt quarry) crushed limestone for concrete, roads, railroad ballast, and agstone. The Feldspar Corp. (Alexander, McCracken, and Reigler mines)mined crude feldspar. J. L. Colville Construction Co. (Colville quarry) crushed granite for concrete and roads.

Transylvania.—Macon Construction Co. (Penrose quarry) crushed granite for concrete and roads. Rock Products, Inc., (McCall mine), Siniard Bros., and Fred McCrary mined structural and paving sand and gravel. Lambert Owen (Talford Cove mine) produced a small quantity of sheet mica.

Union.—Superior Stone Co. (Bakers quarry) and the State highway commission (Monroe quarry) crushed traprock for concrete and roads. Kendrick Brick & Tile Co. (Monroe mine) mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand.

Vance.—The county ranked first in value of mineral production. Tungsten Mining Corp. mined tungsten ore at the Hamme mine and also recovered silver, lead, copper, and gold from tungsten mill tailings. W. E. Graham & Sons (Greystone quarry) produced granite for riprap, concrete, roads, and railroad ballast. The State highway commission mined paving sand.

Wake.—Superior Stone Co. (Rolesville, Garner, and Crabtree quarries) and Nello L. Teer Co. (Raleigh quarry) produced granite for riprap, concrete, roads, and railroad ballast. The State highway commission mined miscellaneous sand.

Washington.—The State highway commission mined paving sand. Weyerhaeuser Co. recovered quicklime at the Plymouth Paper Mill.

Watauga.—Maymead Lime Co., Inc. (Maymead mine) and Clark, Anderson & Guy (Boone mine) mined paving gravel.

Wayne.—Superior Stone Co. (Goldsboro mine) and the State highway commission mined structural and paving sand.

Wilkes.—W. E. Graham & Sons (No. 268 quarry) crushed granite for concrete and roads. Clark, Anderson & Guy (Wilkesboro mine) and the State highway commission mined paving sand and gravel.

Wilson.—Superior Stone Co. (Neverson and Elm City quarries) crushed granite for concrete and roads. Grey Concrete Pipe Co., Inc. (Stantonsbury mine), Deans Sand Co. (Wilson mine), and the State highway commission mined sand and gravel for structural, paving, fill, and stablization uses.

Yadkin.—W. E. Graham & Sons (Cycle quarry) crushed granite for concrete and roads. The State highway commission mined paving sand.

Yancey.—Twelve mines produced mica, four of which produced sheet mica only (punch, full-trimmed and/or hand-cobbed), five produced scrap mica only, and three produced both sheet and scrap mica. The leading producers of sheet mica were Gouge & Allen (Barger mine) and Howard Boone (Little Ray mine). The leading producer of scrap mica was Deneen Mica Co. (Young Mica, Thomas, Gouge, and Kenneth Hall mines). Deneen Mica Co. and Hassett Mining Co. ground mica for roofing, well drilling, and other uses. The Feldspar Corp. (Bacchus mine) and Salley Thomas (Thomas mine) mined crude feldspar. The Feldspar Corp. ground feldspar for glass, pot-

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tery, and other uses. Wiseman Mining Co., Inc. (Wray mine) and Georgia Talc Co. (Spruce Pine mine) mined olivine for refractory use. Powhatan Mining Co. mined asbestos at the Burnsville mine. McCrary Associates (Pensacola mine), Rock Products Inc. (Ray mine), Clark, Anderson & Guy (Burnsville mine), and Yancey Sand & Gravel Co., Inc. (Fox mine) mined structural and paving sand and gravel.

The Mineral Industry of North Dakota

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of North Dakota for collecting information on all minerals except fuels.

By D. H. Mullen [1]

NORTH DAKOTA mineral production was valued at $90.6 million, a gain of 7 percent or $5.6 million more than that of 1961. The mineral fuels output—coal (lignite), natural gas, natural gas liquids, and crude petroleum—was valued at $82.5 million and represented 91 percent of the total value of all mineral production in the State, a gain of 8 percent or $6.2 million more than that of 1961.

Production gains were recorded for each of the mineral fuels, although a slight decline in the value of coal (lignite) output was recorded because of a lowered price per ton.

TABLE 1.—Mineral production in North Dakota [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays—thousand short tons	(2)	(2)	98	$124
Coal (lignite)—do	2,726	$6,141	2,733	6,135
Gem stones	(3)	1	(3)	1
Natural gas—million cubic feet	20,100	2,533	25,155	3,446
Natural gas liquids:				
Natural gasoline and cycle products—thousand gallons	(2)	(2)	16,872	1,085
LP gases—do	(2)	(2)	68,881	2,665
Petroleum (crude)—thousand 42-gallon barrels	23,652	64,333	[4] 25,164	[4] 69,201
Sand and gravel—thousand short tons	9,395	7,507	9,615	7,122
Stone—do	40	40	19	19
Value of items that cannot be disclosed: Salt, uranium ore (1962), and value indicated by footnote 2	----------	4,370	----------	774
Total	----------	[5] 84,925	----------	90,572

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Weight not recorded.
[4] Preliminary figure.
[5] Revised figure.

The Portal Pipe Line Co. system was completed and placed in operation on November 1. At Minot the new pipeline connected the rail terminal of the Great Northern Railway Co. gathering pipeline from fields in northern North Dakota with lines of Lakehead Pipe Line

[1] Mining engineer, Bureau of Mines, Denver, Colo.

Co. and Minnesota Pipe Line Co. at Clearbrook, Minn. The pipeline provided outlets for crude oil to the Northwestern Refining Co. plant at St. Paul Park, Minn., through the Minnesota pipeline and to refineries as far east as Toronto, Ontario, through the Lakehead pipeline. As oil began flowing through the pipeline, two increases in the price of crude oil were announced, the first on November 1 and the second on November 15. The Portal pipeline, second major oil transportation system in North Dakota, complemented the Service Pipe Line system, which transported crude oil from fields on the Nesson anticline to the American Oil Co. refinery at Mandan. Oil-well-drilling activity was less than in 1961; two new fields were discovered. Development drilling resulted in 101 producers from 137 well completions.

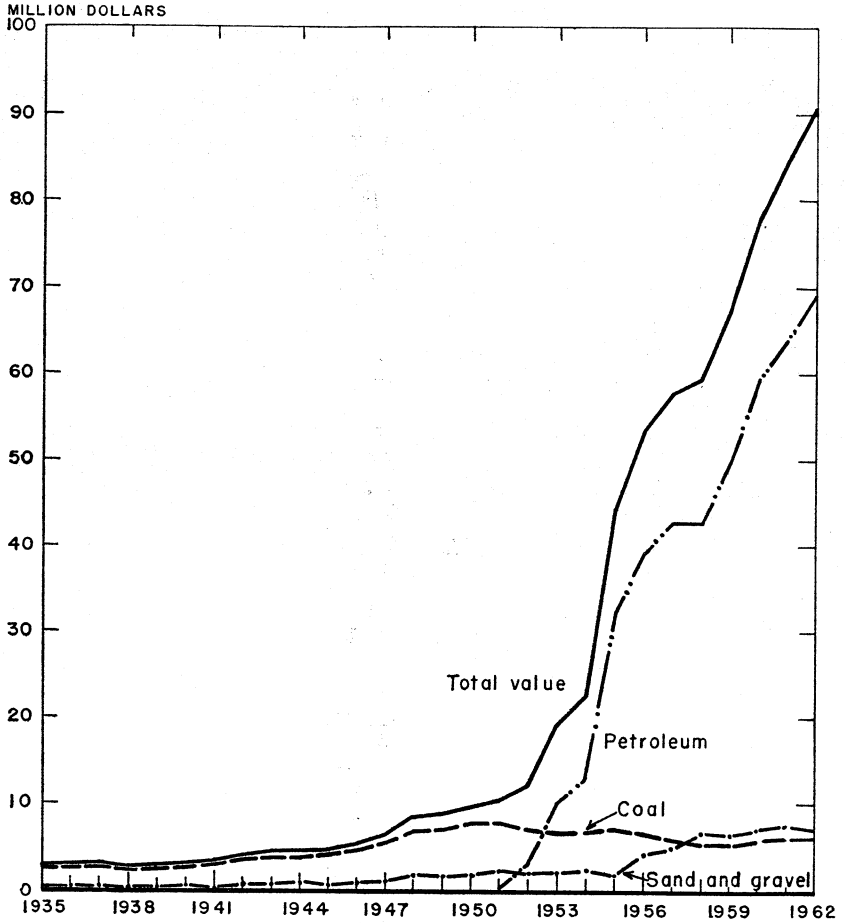

FIGURE 1.—Value of sand and gravel, petroleum, and coal, and total value of mineral production in North Dakota, 1935–62.

Gains were recorded in the production of all nonmetallic minerals except stone and salt—both declined sharply. A small quantity of uranium-bearing lignite ash was shipped to a processing plant at Riverton, Wyo.

Employment and Injuries.—Final data on employment in the mineral industries, excluding all mineral fuels except coal, for 1961 and preliminary data for 1962, compiled by the Bureau of Mines, are shown in table 2.

TABLE 2.—Employment and injuries in the mineral industries[1]

Industry	Number of operations	Average number of men employed	Total man-hours worked	Injuries		Frequency rate (injuries per million man-hours)
				Fatal	Nonfatal	
1961:						
Coal mines	40	317	511,837	----------	12	23.4
Nonmetal mines and mills	11	109	182,357	----------	2	11.0
Stone quarries and mills	21	24	8,560	----------	----------	----------
Sand and gravel	212	884	1,215,754	----------	18	14.8
Total	284	1,334	1,918,508	----------	32	16.7
1962:[2]						
Coal mines	47	318	507,281	1	20	41.4
Nonmetal mines and mills	5	28	28,122	----------	2	71.1
Stone quarries and mills	3	9	5,324	----------	----------	----------
Sand and gravel	122	680	1,082,166	2	15	15.7
Total	177	1,035	1,622,893	3	37	24.6

[1] Excludes employees in all mineral fuels industries except the coal industry, as well as officeworkers.
[2] Preliminary figures.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Lignite).—Production of coal from 32 strip mines and 1 underground mine in 16 counties was just above that of 1961. The value of output, however, was slightly less because of lower average value per ton. Gains in production were recorded in eight of these counties, and declines in the remaining eight.

Basin Electric Power Cooperative was granted a $36.6 million loan by the Rural Electrificatoin Administration (REA) to build a 200-megawatt, lignite-fired, steam-generating plant 4.5 miles southeast of Stanton, on the Missouri River in Mercer County. The site was selected because of favorable ground structure and proximity to sources of lignite, water, rail transportation, and the Bureau of Reclamation power lines. Bids for the turbine generator and the boiler were opened early in October; construction was expected to start in mid-1963. The plant, to consume 1.2 million tons of lignite a year, was to distribute power to consumers in Iowa, Minnesota, Montana, North Dakota, South Dakota, Wisconsin, and Wyoming.

Traux-Traer Coal Co., acquired by Consolidation Coal Co. of Pittsburgh, Pa., became Traux-Traer Coal Co. Division, Consolidation Coal Co.

Knife River Coal Mining Co., a wholly owned subsidiary of Montana-Dakota Utilities Co., announced plans for expanding its lignite-mining operations at Beulah. Four miles south of Beulah, the com-

pany was opening a new mine that was scheduled to be operating by July 1963 and was expected to double the annual output to 1.2 million tons by 1965.

Ames Sand & Gravel, Inc., of Fargo began negotiating with the U.S. Army Corps of Engineers for purchasing lignite stockpiled at the Garrison Dam and announced plans to construct a carbonization plant near Riverdale for producing lignite char. The plant was to produce 350,000 tons of char per year for reducing taconite at a pilot plant to be built at Gilbert, Minn., by W. S. Moore Co. of Duluth.

The U.S. Air Force let contracts for lignite to be used for energy needs at the Grand Forks and Minot Air Force Bases. Lignite had been used at the Grand Forks base for the past 3 years.

Construction of the $10.5 million expansion project at the R. M. Heskett steam generating plant at Mandan by Montana-Dakota Utilities Co. continued, completion being scheduled for late 1963.

TABLE 3.—Coal (lignite) production by counties

(Excludes mines producing less than 1,000 short tons)

County	1961		1962	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Adams	17,849	$3.66	20,846	$2.62
Bowman	172,058	1.89	192,782	1.88
Burke	410,858	2.33	398,499	2.37
Burleigh	13,084	3.33	10,734	3.32
Divide	214,659	2.45	229,907	2.46
Dunn	6,148	2.92	3,959	2.92
Grant	21,964	2.87	23,841	3.03
Hettinger	3,100	3.70	2,580	3.70
McLean	82,597	3.18	84,568	3.19
Mercer	1,053,013	2.16	1,042,475	2.14
Morton	18,888	2.51	[2] 20,394	[2] 2.56
Mountrail			[2]	[2]
Oliver	8,728	2.41	11,612	2.50
Stark	102,278	1.88	92,916	1.81
Ward	599,065	2.22	595,682	2.22
Williams	1,981	4.78	2,059	4.70
Total	2,726,270	2.25	2,732,854	2.24

[1] Value received or charged f.o.b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked, as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

[2] Production of Mountrail County combined with Morton County to avoid disclosing individual company confidential data.

The Bureau of Mines continued its long-range research program at its Charles R. Robertson Lignite Research Laboratory at Grand Forks. The program included investigating the storage, pulverization, and freezeproofing of lignite and also an extensive survey to determine the fundamental characteristics and utilization of lignite. A significant advance in the economic production of industrial gas directly from lignite was made at the laboratory during 1962. Reports of the investigations were published.[2]

[2] Ellman, R. C., J. W. Belter, and L. Dockter. Effects of In-the-Mill Drying on Pulverizing Characteristics of Lignite. BuMines Rept. of Inv. 6074, 1962, 18 pp.

Gronhovd, G. H., A. E. Harak, W. R. Kube, and W. H. Oppelt. Design and Initial Operation of a Slagging, Fixed-Bed, Pressure Gasification Pilot Plant. BuMines Rept. of Inv. 6085, 1962, 50 pp.

Natural Gas.—Dry natural gas from fields in Bowman County and residual gas from natural gas processing plants in Williams and Burke Counties were marketed through pipelines of Montana-Dakota Utilities Co. The quantity sold was 25 percent more than that of 1961. The natural gas processing plant at Tioga was operated the entire year; new plants at McGregor in Williams County and at Lignite in Burke County also were operated throughout most of 1962. Reports [3] by the North Dakota Geological Survey showed that total production of dry gas was 494.6 million cubic feet and that 25.4 billion cubic feet of oil well gas was treated at the processing plants from which 12.6 billion cubic feet of residual gas was marketed.

Natural Gas Liquids.—Natural gasoline, propane, and butane were recovered at two processing plants in Williams County and at one plant in Burke County. One plant at McGregor in Williams County and another at Lignite in Burke County began operations in March. Reports [4] of the State Geological Survey showed that 25.4 billion cubic feet of oil well gas was processed with the recovery of 17.3 million gallons of natural gasoline, 28.7 million gallons of butane, and 47.6 million gallons of propane. The butane and propane recovered were stored in an underground storage facility at Mentor, Minn., and in underground caverns created by solution salt mining at Williston. Natural gasoline was used as a blending stock at the refinery at Mandan. Residual gas (12.6 billion cubic feet) was marketed through pipelines of Montana-Dakota Utilities Co. Elemental sulfur (22,711 long tons) was recovered as a byproduct of natural gas processing at the Tioga and Lignite plants.

Petroleum. Production of petroleum from 1,674 wells in 12 counties was 6 percent above that of 1961. The value of production was 8 percent greater than in 1961 because of increases in prices posted—effective on November 1 and November 15—by purchasers of crude oil. The two increases, each approximately $0.20 per barrel, raised the average price to $2.75 per barrel for the year, compared with the 1961 price of $2.72, which had prevailed within narrow limits for 5 years. Yearend prices posted by United States Crude Oil Purchasing Co. at various northern county fields ranged from $2.00 to $2.82 per barrel. Prices posted by Indiana Oil Purchasing Co. at fields on the Nesson anticline ranged from $2.72 per barrel to $2.95, depending upon the gravity.

Data [5] prepared by the North Dakota Geological Survey showed that five operating companies accounted for 74 percent of the total production in the State in 1962. These same five operators had produced 86 percent of all the petroleum produced in the State since the original discovery at the Clarence Iverson No. 1 well in 1951. Leading producers were Amerada Petroleum Corp.; Pan American Petroleum Corp.; Texaco Inc.; the Hunt interests composed of Hunt Oil Co., H. L. Hunt, and W. H. Hunt; and California Oil Co.

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[3] Laird, Wilson M. Oil in North Dakota, First Half 1962. N. Dak. Geol. Survey Bull., October 1962, 124 pp.
Laird, Wilson M. Oil in North Dakota, Second Half 1962. N. Dak. Geol. Survey Bull., April 1963, 121 pp.
[4] Work cited in footnote 3.
[5] Work cited in footnote 3.

TABLE 4.—Crude petroleum production by counties [1]

(Thousand barrels)

County	1961	1962 [2]	Principal fields in 1962 in order of production
Billings	607	647	Fryburg, Rocky Ridge.
Bottineau	3,120	2,674	Newburg, South Westhope, Wiley, Haas, North Westhope.
Bowman	384	884	Cedar Creek.
Burke	3,945	3,752	Rival, North Tioga, Black Slough, Portal, Lignite.
Divide	443	368	North Tioga, Stoneview.
Dunn	66	43	Lost Bridge.
McHenry	10	11	Pratt.
McKenzie	6,045	6,477	Blue Buttes, Antelope, Charlson, Clear Creek.
Mountrail	1,455	1,471	Tioga, White Earth.
Renville	1,378	1,972	Glenburn, Sherwood.
Stark	30	48	Dickinson.
Williams	6,169	6,817	Beaver Lodge, Tioga, Capa, Grenora.
Total	23,652	25,164	

[1] Based on North Dakota Geological Survey county data adjusted to Bureau of Mines total.
[2] Preliminary figures.

TABLE 5.—Wildcat- and development-well completions in 1962, by counties [1]

County	Crude	Dry	Service	Total	Footage
Wildcat:					
Bottineau	2	26		28	114,800
Burke		9		9	54,200
Divide	1	4		5	39,300
Dunn		3		3	31,100
Grand Forks		3		3	
McHenry		11		11	42,200
McKenzie		5		5	40,000
McLean		2		2	10,500
Mountrail		3		3	26,600
Oliver		1		1	8,000
Renville		9		9	42,500
Rolette		1		1	3,000
Sargent		1		1	1,200
Ward		7		7	34,500
Williams		4		4	34,400
Total	3	89		92	482,300
Development:					
Billings	1	1	1	3	24,600
Bottineau	25	16		41	155,000
Bowman	19	1		20	169,600
Burke	27	8		35	224,800
McHenry	1			1	4,200
McKenzie	10	1		11	115,000
Renville	9	2	1	12	51,600
Stark		1		1	10,200
Williams	9	4		13	108,000
Total	101	34	2	137	863,000
Grand total	104	123	2	229	1,345,300

[1] No condensate or gas wells.

Source: Oil and Gas Journal.

The most significant development in the State during the year was completion of the Portal pipeline from Minot to Clearbrook, Minn. The existing gathering system from the Newburg, Wiley, and Glenburn fields with tank-car loading facilities at Minot became an integral part of the Portal system. Company organization included Great Northern Railway Co., Hunt Oil Co., and Northwestern Refining Co., with Hunt Oil Co.—as a separate entity—operating the pipeline. At Clearbrook the Portal line connected not only with the Lakehead

Pipe Line Co. line, which served areas as far east as Toronto, Ontario, with a scheduled extension to Buffalo, N.Y., but also connected with the Minnesota Pipe Line Co. line, which delivered crude oil to the Northwestern Refining Co. plant at St. Paul Park, Minn. Plans were announced to extend the Portal system to other fields in the northern and northwestern parts of North Dakota.

Drilling was at a lower rate than in 1961 with 221 completions reported by the State Geological Survey,[6] compared with 257 in 1961. Of the 221 wells completed, 109 were development wells, including 80 producers; and 66 were exploratory wells, including 2 producers. Outpost, extension, and stratigraphic tests accounted for the 46 remaining wells of which 23 were producers. Two new fields, one each in Bottineau and Divide Counties, were discovered. A new producing horizon also was discovered at the Landa field in Bottineau County. Total drilling was 1.3 million feet, compared with 1.5 million feet in 1961.

Most of the development drilling was in Bottineau, Burke, McHenry, and Williams Counties and in the Little Missouri and Cedar Creek areas in Bowman County. The operation of the Portal pipeline system that began on November 1 was expected to generate significant development and exploratory drilling in the northern and northwestern counties.

The State Geological Survey completed an inventory of crude oil reserves as of January 1, 1963. The report,[7] to be published early in 1963, showed an original primary and secondary reserve of 731.7 million barrels; total production was 152.8 million barrels through 1962, leaving a recoverable reserve of 578.9 million barrels. At the close of 1962, the 78 fields contained 94 producing pools.

Refineries at Mandan and Williston were operated the entire year. Throughput was 16 million barrels of crude oil, a 3-percent gain over that of 1961.

NONMETALS

Clays.—Building brick and tile, draintile, and heavy clay products were produced from miscellaneous clays mined in Adams and Morton Counties and from clay, classified as fire clay, mined in Stark County. A substantial part of the miscellaneous clay mined in Morton County and all of that mined in Divide County was used in manufacturing lightweight aggregates. A small quantity of bentonite produced in Morton County was used in prepared mortars.

Gem stones.—Societies and individuals collected gem material (agatized wood, chalcedony, jasper, and quartzite) in various parts of the State but mainly from Billings, Morton, and Stark Counties.

Salt.—Salt was recovered by solution mining of salt beds in the Charles formation through wells 8,500 feet deep at Williston, Williams County. The quantity recovered was 20 percent less than that of 1961. Caverns created by the salt-mining operations were used for storing liquid petroleum gases.

[6] Work cited in footnote 3.
[7] Folsom, Clarence B., Jr. North Dakota Crude Oil Inventory as of January 1, 1963. N. Dak. Geol. Survey, Misc. Series No. 17. 1963, 14 pp.

Sand and Gravel.—Production of sand and gravel from 46 of the 53 counties was 2 percent more than that of 1961; the value, however, declined by 5 percent. The greatest consumption of sand and gravel was by Government agencies and contractors in constructing, maintaining, and repairing Federal, State, and county highways. Production by Government agencies and contractors represented 73 percent of the total; of this, 31 percent was by and for the U.S. Army Corps of Engineers, 51 percent by and for the North Dakota State Highway Department, 17 percent for county highway departments, and 1 percent for municipalities. Production by and for the State highway department reflected the continued progress in constructing highways with Federal aid. According to a report [8] by the Bureau of Public Roads, 25.1 miles of the National System of Interstate and Defense Highways was completed to standards during 1962; at year-end 39 miles was under construction; and engineering studies and acquisition of right-of-way were in progress on 85.7 miles of the system. Under the Federal aid program for primary, secondary, and urban highways, 591.2 miles of highway was completed, and 903 miles was at various stages of construction. In addition, county governments were engaged in constructing and maintaining highways as were municipal governments in building, improving, and maintaining city streets. Prices for sand and gravel ranged from $1.81 per ton for washed building gravel to $0.18 per ton for pit-run gravel used for highway fills. Counties leading in the production of sand and gravel were Cass (806,700 tons), Ward (724,800), McHenry (574,400), Walsh (504,400), Morton (465,700), and Burleigh (409,600).

Stone.—Crushed stone for constructing highways was produced in Cass and Stark Counties for the State highway department. A small quantity of broken stone for riprap was produced in Sioux County. The total produced was considerably below that of 1961.

Sulfur.—Elemental sulfur was recovered at natural gas processing plants at Tioga, Williams County, and at Lignite, Burke County. The quantity shipped was 22 percent below that of 1961. Because of the difficulty of determining the country of origin of some elemental sulfur recovered at some plants in the United States, particularly those processing crude oil from foreign countries, neither the quantity nor the value of the recovered sulfur was included as mineral production.

Vermiculite.—Crude vermiculite from deposits in Montana was exfoliated at a plant in Ward County. The processed product was used for insulation, as a lightweight aggregate, and as a soil conditioner. The quantity sold was slightly below that of 1961.

[8] Bureau of Public Roads. Quarterly Report on the Federal-Aid Highway Program, Dec. 31, 1962. Press Release BPR 63–10, Feb. 10, 1963.

TABLE 6.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Construction:				
Building	297	$348	399	$469
Paving	61	59	17	20
Railroad ballast	(1)	(1)		
Fill	26	17	(1)	(1)
Other	2	2	37	30
Total	386	426	453	519
Gravel:				
Construction:				
Building	322	640	446	808
Paving	671	450	1,156	662
Railroad ballast	154	70	117	46
Fill	163	61	381	164
Other	23	7	11	6
Miscellaneous	(1)	(1)	29	19
Total	1,333	1,228	2,140	1,705
Total sand and gravel	1,719	1,654	2,593	2,224
Government-and-contractor operations:				
Sand:				
Building	18	9	100	50
Paving	391	299	346	336
Total	409	308	446	386
Gravel:				
Building	111	73	192	264
Paving	7,145	5,464	4,905	3,980
Fill	9	7	1,479	268
Other	2	1		
Total	7,267	5,545	6,576	4,512
Total sand and gravel	7,676	5,853	7,022	4,898
All operations:				
Sand	795	734	899	905
Gravel	8,600	6,773	8,716	6,217
Total	9,395	7,507	9,615	7,122

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

METALS

Uranium Ore.—International Resources Corp., Rapid City, S. Dak., was unable to meet the requirements of the Atomic Energy Commission (AEC) for constructing a plant to process uranium-bearing lignites of North and South Dakota. Negotiations for purchasing the uranium oxide concentrate that would have been recovered from the lignites were terminated early in January. Susquehanna-Western, Inc., with uranium processing plants at Riverton, Wyo., and at Edgemont, S. Dak., planned to buy uranium-bearing material from producers and to deliver the recovered uranium oxide concentrate within its purchase contracts with AEC. Kerr-McGee Oil Industries, Inc., announced plans to build a processing plant either in North or South Dakota to prepare the lignites for extracting the contained uranium. A portable kiln was planned that would burn the carbonaceous

material to a residue of ash or clinker that could be processed at uranium mills. Manidon Mining Co., with extensive lignite holdings in southwest North Dakota, stripped a lignite bed and burned it in place. A small quantity of the resulting ash was shipped to the Susquehanna-Western, Inc., plant at Riverton, Wyo., for recovery of the contained uranium oxide. Uranium-bearing lignites under about 15 feet of cover in Slope and Billings Counties contained as much as 0.10 to 0.20 percent uranium oxide. After stripping, the beds were set afire with propane torches and compressed air. The lignite burned to ash in 30 to 60 days, depending upon the thickness; the ash was then ready for shipment to the processing plant. At yearend, negotiations were in progress between AEC and Kerr-McGee Oil Industries, Inc., as well as others, on a contract for purchasing uranium oxide from the uraniferous lignites.

REVIEW BY COUNTIES

Only counties with significant production or outstanding developments in the mineral industries are discussed below. See table 7 for additional details.

Billings.—The county was ranked eighth in the State in petroleum production. Output from the 30 wells in the Fryburg, Rocky Ridge, Scoria, Elk Horn Ranch, and Blacktail fields was 7 percent more than that of 1961. No exploratory drilling was conducted during the year; one service well was completed. Among the three development wells completed, one was an oil producer. Manidon Mining Co. shipped a small quantity of ash to the Susquehanna-Western, Inc., uranium processing plant at Riverton, Wyo., for recovery of the contained uranium oxide. This was the first shipment of uranium-bearing material from North Dakota deposits since some test shipments of lignite were made in 1956. The ash was derived from burning uranium-bearing lignite in place. Economic methods of mining and processing the lignite led to considerable development work in 1962, and the company planned to extend operations in 1963. A small quantity of paving gravel was produced for the State highway department.

Bottineau.—The county was ranked fourth in the State in petroleum production. Output from 273 wells in 17 fields was 14 percent below that of 1961. Exploratory drilling of 28 wells resulted in the discovery of 1 new field and a new producing horizon in the Northeast Landa field. In December, Texota Oil Co. completed the No. 1 Lillie in sec. 10, T. 161 N., R. 81 W. Initial production was 134 barrels of oil per day, pumped from the Mission Canyon formation from a depth of 4,008 to 4,011 feet; total depth of the well was 4,081 feet. During December, 183 barrels of oil was produced. Early in 1962, Cardinal Petroleum Co. completed the No. 1 Aften in sec. 6, T. 163 N., R. 78 W., in the Northeast Landa field. Initial production of 123 barrels of oil per day was pumped from the Spearfish formation from a depth of 3,031 to 3,036 and from 3,045 to 3,051 feet; total depth of the well was 3,084 feet. Total production from the well was 16,227 barrels of oil. Previous production was from the Madison limestone. Development drilling in the North Haas, Wayne, and Newburg fields resulted in 25 producing wells from 41 completions. Paving sand and gravel was produced for the State highway department.

TABLE 7.—Value of mineral production in North Dakota, by counties [1]

County	1961	1962 [2]	Minerals produced in 962 in order of value
Adams	$65,502	$54,717	Coal, clays.
Barnes	447,200	215,300	Sand and gravel.
Benson	102,400	65,300	Do.
Billings	[3] 1,724,336	1,817,069	Petroleum, natural gas, uranium ore, sand and gravel, gem stones.
Bottineau	[3] 8,540,100	7,439,600	Petroleum, sand and gravel, natural gas.
Bowman	[3] 1,428,333	2,844,203	Petroleum, coal, natural gas.
Burke	[3] 13,408,532	13,329,764	Petroleum, coal, natural gas, LP gases, natural gasoline, sand and gravel.
Burleigh	479,570	537,537	Sand and gravel, coal.
Cass	911,588	(4)	Sand and gravel, stone.
Cavalier	58,437	99,500	Sand and gravel.
Dickey	95,031	44,300	Do.
Divide	[3] 2,147,058	1,745,114	Petroleum, coal, sand and gravel, natural gas, LP gases, clays, natural gasoline.
Dunn	[3] 271,310	161,360	Petroleum, sand and gravel, coal, natural gas.
Eddy	194,300	(4)	Sand and gravel.
Emmons	95,100	30,200	Do.
Foster	8,912	23,900	Do.
Grand Forks	166,900	325,700	Do.
Grant	62,993	77,893	Coal, sand and gravel.
Griggs	7,300	5,400	Sand and gravel.
Hettinger	217,256	77,146	Sand and gravel, coal.
Kidder	3,400	2,500	Sand and gravel.
LaMoure	19,800	54,200	Do.
Logan	56,600	----------	
McHenry	149,900	561,530	Sand and gravel, petroleum, natural gas.
McIntosh	67,900	38,600	Sand and gravel.
McKenzie	[3] 18,339,347	19,695,000	Petroleum, LP gases, natural gas, natural gasoline sand and gravel.
McLean	548,106	329,441	Coal, sand and gravel.
Mercer	(4)	2,293,909	Do.
Morton	258,723	547,370	Sand and gravel, clays, coal, gem stones.
Mountrail	[3] 4,227,700	4,338,590	Petroleum, natural gas, coal.
Nelson	103,513	53,600	Sand and gravel.
Oliver	38,413	28,982	Coal.
Pembina	313,600	9,200	Sand and gravel.
Pierce	28,900	(4)	Do.
Ramsey	5,212	33,600	Do.
Ransom	40,800	22,400	Do.
Renville	[3] 3,825,500	5,459,400	Petroleum, natural gas, sand and gravel.
Richland	37,100	121,500	Sand and gravel.
Rolette	65,600	54,400	Do.
Sargent	134,832	59,200	Do.
Sheridan	32,500	29,200	Do.
Sioux	----------	(4)	Do.
Slope	18,878	9,100	Do.
Stark	[3] 408,674	489,367	Sand and gravel, coal, petroleum, clays, stone, natural gas, gem stones.
Steele	39,200	19,600	Sand and gravel.
Stutsman	397,600	285,000	Do.
Towner	300	(4)	Do.
Traill	261,199	153,000	Do.
Walsh	204,200	446,900	Do.
Ward	2,153,288	2,014,993	Coal, sand and gravel.
Wells	8,613	135,500	Sand and gravel.
Williams	[3] 20,287,988	22,164,997	Petroleum, LP gases, natural gas, salt, natural gasoline, sand and gravel, coal.
Undistributed [5]	[3] 2,415,487	2,227,064	
Total	[3] 84,925,000	90,572,000	

[1] Golden Valley is not listed, because no production was reported.
[2] Petroleum values are preliminary.
[3] Revised figure.
[4] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[5] Includes some sand and gravel and gem stones that cannot be assigned to specific counties, and values indicated by footnote 4.

Bowman.—The county was ranked seventh in the State in petroleum production. Output from 30 wells in the Cedar Creek and Little Missouri fields was more than double that of 1961. Extensive development drilling at the Cedar Creek field resulted in 31 flowing wells; 2 were shutin at the end of 1962. Dry natural gas output, produced from 28 wells at the Cedar Creek and Little Missouri fields from the Eagle

sandstone, was 22 percent above that of 1961. The gas was marketed through pipelines of Montana-Dakota Utilities Co. Coal production by the Knife River Coal Mining Co. at the Peerless strip mine was 12 percent more than that of 1961.

Burke.—Petroleum production from 272 wells in 19 fields was 5 percent less than that of 1961; the county, however, retained its position as the third largest source of petroleum in the State. Eight exploration wells were failures, and 27 of 35 development wells were producers. Development drilling was mainly in the Black Slough, Foot Hills, Lignite, and Woburn fields. In March, TXL (Texaco Inc.) completed and began operating its natural gas processing plant at Lignite. Natural gasoline, butane, propane, and elemental sulfur were recovered. Residual gas was marketed through pipelines of Montana-Dakota Utilities Co. Oilwell gas processed at the plant was from the Black Slough, Flaxton, Foot Hills, North Foot Hills, Portal, Rival, and Woburn fields, all within the county. Oil well gas from the North Tioga field in Burke and Divide Counties was processed at the Hunt Oil Co. plant at McGregor. Coal production, all by Truax-Traer Coal Co. at the Kincaid strip mine and by LeRoy Bonsness at the Bonsness strip mine, was 3 percent less than that of 1961. Building sand and gravel was produced by Sandberg Sand & Gravel of Lignite, and paving gravel was produced by and for the State and county highway departments.

Burleigh.—The county was ranked sixth in the State in sand and gravel production. Output was by Dakota Sand & Gravel Co. and Northern Improvement Co., both of Bismarck, for building, paving, and fill. Paving sand and gravel produced for the State highway department mostly was used on Interstate Highway 94. Coal production by Ecklund-Taplin Coal Co. was 18 percent less than that of 1961.

Cass.—The county led the State in output of sand and gravel, all produced by contractors for the State highway department for constructing Interstate Highways 94 and 29, which intersect at Fargo. Crushed rock was produced by contractors for the same highway project.

Divide.—Production of petroleum from 32 wells in 5 fields was 17 percent less than that of 1961. One new field, Wildrose, was discovered from five exploratory wells completed. The No. 1 Roston well, completed by Hunt Oil Co. in sec. 30, T. 160 N., R. 97 W., in May, flowed 144 barrels of oil per day from the Madison limestone from a depth of 7,956 to 7,999 feet; total depth of this well was 8,576 feet. The discovery was 12 miles northwest of the nearest producing well and 3 miles from any previous drilling. Subsequent southeastern and southwestern extensions were dry and were abandoned. Total production of the discovery well was 8,282 barrels of oil. Oil well gas from the North Tioga field that lies in both Burke and Divide Counties was processed at the Hunt Oil Co. plant at McGregor. Coal production, all by Baukol-Noonan, Inc., at the Baukol-Noonan strip mine, was 7 percent more than in 1961. Miscellaneous clay was mined by Baukol-Noonan, Inc., for manufacturing lightweight aggregates. Building sand and gravel and gravel fill were produced by Susag Sand & Gravel and Anderson Lumber, both of Crosby. Soo Line Railroad

Co. produced gravel for ballast. Divide County Highway Department produced paving gravel.

Dunn.—Petroleum production from the one well in the Lost Bridge field was 35 percent less than that of 1961. Three exploratory wells drilled were failures, and no development drilling was done. Coal production from the Pelton coal mine was 36 percent less than that of 1961. Paving gravel was produced for the State highway department.

McHenry.—Production of petroleum from the Pratt field was 10 percent more than that of 1961. Eleven exploratory wells were failures, and the one development well at the Pratt field flowed 75 barrels of oil per day. Production from the new well during November and December was 3,127 barrels of oil. The county was ranked third in the State in sand and gravel production. Contractors produced building sand and gravel for the U.S. Army Corps of Engineers and paving sand and gravel for the State highway department. Great Northern Railway Co. produced building gravel and railroad ballast.

McKenzie.—The county remained second in the State in the production of petroleum. Output from 416 wells in 14 fields was 7 percent more than that of 1961. Exploratory drilling was limited to five wells; all were dry and abandoned. Among 11 development wells completed were 10 producers. The county highway department produced paving sand, and contractors produced paving sand and gravel for the State highway department.

Mercer.—The county continued to lead the State in production of coal. The four operating companies produced 38 percent of the State's 2.7 million tons. Major producers were Knife River Coal Mining Co., operating the Beulah strip mine; The North American Coal Corp., operating the Indian Head strip mine; and Truax-Traer Coal Co., operating the Dakota Star strip mine. Knife River Coal Mining Co., a wholly owned subsidiary of Montana-Dakota Utilities Co., began expanding its operations at Beulah. A new mine opened 4 miles south of Beulah was expected to be in operation by June 1963. The operation of the two mines was expected to make Knife River one of the principal producers in the Midwest. Production of 1.2 million tons annually was expected by 1965. Missouri River Sand & Gravel of Stanton produced building and paving sand and gravel.

Morton.—Miscellaneous clay was produced for manufacturing building brick and tile, draintile, other heavy clay products, and lightweight aggregate. A small quantity of bentonite was mined for use in prepared mortars. Sand and gravel produced for the State highway department principally was used in constructing Interstate Highway 94 in the vicinity of Mandan. Building sand and gravel and railroad ballast and fill gravel were produced by Helm Brothers, Inc., and Mandan Transfer & Storage, Inc., both of Mandan. Northern Pacific Railway Co. mined sand and gravel for fill. Paving sand and gravel was produced by and for the State and county highway departments. Coal output by Kaelberer Coal Co., Richter Coal Mine, and Timpe & Nilles Coal Co. was 1 percent less than that of 1961. Individuals collected agatized wood for use as gem material.

Mountrail.—The county was ranked sixth in the State in petroleum output; production came from 129 wells in 3 fields and was slightly more than that of 1961. Major production continued to be from that

part of the Tioga field in Mountrail County. Oil well gas from the field was processed at the Tioga gasoline plant. No development drilling was done; three exploratory wells drilled were dry and were abandoned.

Renville.—The county was ranked fifth in the State in petroleum production. Output from 69 wells in 4 fields was 43 percent more than that of 1961. Nine exploratory wells drilled were dry and were abandoned. Among 12 development wells completed were 9 producers in the Eden Valley, Elmore, and Glenburn fields. Mohall Excavating Service produced sand and gravel for building and fill.

Stark.—Fire clay was mined for manufacturing building brick and tile and other heavy clay products. Petroleum production from three wells in the Dickinson field, producing from two horizons, was 60 percent above that of 1961. The county was ranked tenth in the State in petroleum output. Coal production by Dickinson Coal Mining Co. (at the Dickinson and Lehigh strip mines) and Walters Coal Mine was 9 percent less than that of 1961. Individuals collected gem materials—chalcedony, jasper, and quartzite. Sand and gravel for building, paving, and fill material was produced by Badinger Sand & Gravel Pit; Fisher Sand & Gravel Co.; and Kovash, Inc.—all of Dickinson. Contractors produced paving gravel and crushed stone for the State highway department.

Walsh.—The county was ranked fourth in the State in sand and gravel production. Bradshaw Gravel Supply at Arvilla, Cudmore Gravel at Park River, and Ellingson Gravel Co. at Edinburg produced building and paving sand and gravel. Soo Line Railroad Co. produced gravel for railroad ballast and fill. Paving sand and gravel was produced by and for the State highway department for use in constructing the north-south Interstate Highway 29.

Ward.—The county was ranked second in the State in the production of lignite and sand and gravel. Sawyer Fuels, Inc., the Miller strip mine; Truax-Traer Coal Co., the Velva strip mine; and Valley Coal Co., the Valley strip mine, produced slightly less coal than in 1961. Atlas Sand & Gravel, Inc., Minot Sand & Gravel Co., and Schriock Construction produced sand and gravel for building, paving, and fill. Soo Line Railroad Co. and Great Northern Railway Co. produced gravel for ballast and fill. The county highway department produced paving gravel. Contractors also produced paving gravel for the State highway department for use on the east-west Interstate Highway 94. Commercial operators produced sand and gravel for the U.S. Army Corps of Engineers for use at Minot Air Force Base. Robinson Insulation Co. exfoliated crude vermiculite at its plant at Minot for use as insulation, lightweight aggregate, and in soil conditioning. Crude material was from deposits in Montana.

Williams.—The county retained its leading position as a source of petroleum; output from 419 wells in 11 fields was 10 percent more than that of 1961. Four exploratory wells were failures. Among 13 development wells completed were 9 producers concentrated in the Grenora field near the Montana State line. The field underwent considerable development from July 1961 through December 1962, and at yearend the 13 wells in the field were producing at an average rate of more than 1,500 barrels of oil per day. Major producing fields in the county

continued to be the Tioga and Beaver Lodge fields and others along the Nesson anticline. Signal Oil & Gas Co. operated its natural gas plant at Tioga and recovered natural gasoline, butane, propane, and elemental sulfur. Residual gas was marketed through pipelines of Montana-Dakota Utilities Co. Oil well gas was delivered to the plant through a pipeline system from fields along the Nesson anticline extending for 300 miles from Burke County on the north into McKenzie County on the south. The Hunt-Herbert Trusts completed and began operating its natural gas plant at McGregor in March and recovered natural gasoline and some butane and propane. Residual gas was marketed through pipelines of Montana-Dakota Utilities Co. Oil well gas for the plant came from the North Tioga and North Tioga Extension fields in Burke and Divide Counties. Westland Oil Co. operated its 2,500-barrel-per-day refinery at Williston. Throughput was 8 percent more than that of 1961.

Coal production from the only underground mine in the State—the Black Diamond operated by Ben L. Nelson & Jacob Senti—was 4 percent more than that of 1961.

Salt production by solution mining through wells to the Charles formation at Williston by Dakota Salt & Chemical Co. was 19 percent less than that of 1961. Caverns created by salt mining were utilized for storing liquid petroleum gases. A variety of gem-stone materials—agate, agatized wood, chalcedony, jasper, and quartzite—were collected by individuals.

Building and paving sand and gravel were produced by Borsheim Builders Supply, Dale Shubert, and Charles Vizina, all of Williston, and Mattson Trucking of Tioga. Contractors produced paving sand and gravel for the State and county highway departments.

707-643—63——52

The Mineral Industry of Ohio

By Joseph Krickich [1] and Roy H. Davis [2]

GREATER demand for construction and chemical materials and fuels helped increase the total value of Ohio mineral production by over $11 million above that of 1961. The rise in total mineral value was resumed in 1962 after the value had dropped each year from the record high set in 1959. The increase was paced by greater production of bituminous coal, cement, salt, lime, sand and gravel, and stone, the leading minerals of Ohio. A record high was established in the production and value of salt. Although production and shipments increased, a drop in the average unit price resulted in lower value of cement shipments. Ohio continued to lead the United States in the output of clays, lime, and ferroalloys, and was an important producer of coal, salt, iron and steel, and beryllium.

TABLE 1.—Mineral production in Ohio [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland, 376-pound barrels	15,302,855	$53,251	15,352,969	$51,006
Masonry, 280-pound barrels	846,082	2,604	945,912	2,793
Clays, thousand short tons	4,923	13,790	4,751	12,979
Coal (bituminous), do	32,226	121,343	34,125	127,051
Gem stones	(2)	4	(2)	3
Lime, thousand short tons	[3] 3,048	[3] 41,266	3,102	43,792
Natural gas, million cubic feet	36,423	9,069	36,747	9,407
Peat, short tons	9,113	123	7,783	106
Petroleum (crude), thousand 42-gallon barrels	5,639	17,425	[4] 5,066	[4] 15,705
Salt, thousand short tons	3,465	25,037	4,187	28,706
Sand and gravel, do	33,688	41,272	35,204	43,333
Stone, do	33,652	55,701	34,470	57,202
Value of items that cannot be disclosed: Abrasive stones and gypsum		1,566		1,588
Total		[3] 382,451		393,671

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Revised figure.
[4] Preliminary figure.

[1] Minerals specialist, Bureau of Mines, Pittsburgh, Pa.
[2] Statistical assistant, Bureau of Mines, Pittsburgh, Pa.

Employment and Injuries.—Preliminary data for selected mineral industries indicated that man-hours worked and the average number of men working daily decreased compared with 1961. The safety record of the bituminous coal industry did not improve, and the number of fatal injuries increased. However, the rate of 0.38 fatalities per million tons was the lowest in the Nation. Of the 13 coal mine fatalities, 9 occurred at underground mines, 3 at strip mines, and 1 at an auger mine. The underground fatalities were caused primarily by falls of roof.

TABLE 2.—Employment and injuries for selected mineral industries [1]

Industry	Men working daily	Man-hours worked	Number of injuries		Injuries per million man-hours	
			Fatal	Nonfatal	Fatal	Nonfatal
1961:						
Cement	1,577	4,272,696	----------	10	----------	2.34
Clays [2]	620	957,083	----------	21	----------	21.94
Coal (bituminous)	8,114	13,648,234	9	292	.66	21.39
Nonmetal mines [3]	241	485,542	----------	7	----------	14.42
Quarries and mills [4]	4,229	9,376,193	4	153	.43	16.32
Sand and gravel [5]	2,399	5,702,304	2	65	.35	11.40
1962: [6]						
Cement	1,477	3,221,000	----------	9	----------	2.79
Clays [2]	504	758,000	----------	20	----------	26.39
Coal (bituminous)	6,700	13,970,000	13	300	.93	21.47
Nonmetal mines [3]	249	460,000	----------	6	----------	13.04
Quarries and mills [4]	4,124	9,021,000	3	165	.33	18.29
Sand and gravel [5]	2,200	4,269,000	----------	63	----------	14.76

[1] Production employees.
[2] Mines only.
[3] Includes abrasives, gypsum, and salt.
[4] Includes lime plants having no quarry operations.
[5] Commercial producers only.
[6] Preliminary figure.

Some Ohio mines compiled noteworthy records for 1962 in various safety competitions. In the National Safety Competition, winners of a Certificate of Achievement in Safety for working without any lost-time injuries during the year, in decreasing order of man-hours worked, were:

Quarry Group:
- The J. E. Baker Co., Millersville
- Marquette Cement Mfg. Co., Pedro
- The National Lime & Stone Co., Findlay
- United States Gypsum Co., Genoa
- Toledo Stone & Glass Sand Co., Sylvania
- Universal Atlas Cement Division, United States Steel Corp., Fairborn
- The National Lime & Stone Co., Carey
- National Gypsum Co., Gibsonburg
- Southwestern Portland Cement Co., Fairborn
- Standard Lime & Cement Co., Division of Martin Marietta Corp., Woodville
- The National Lime & Stone Co., Buckland

Open-Pit Group:
- Hanna Coal Co. Division of Consolidation Coal Co., New Athens
- Hanna Coal Co. Division of Consolidation Coal Co., Cadiz
- Cross Creek Coal Co., New Philadelphia
- Keller Mines, Inc., Sebring

Nonmetal Group:
- Columbia Cement Corp., East Fultonham

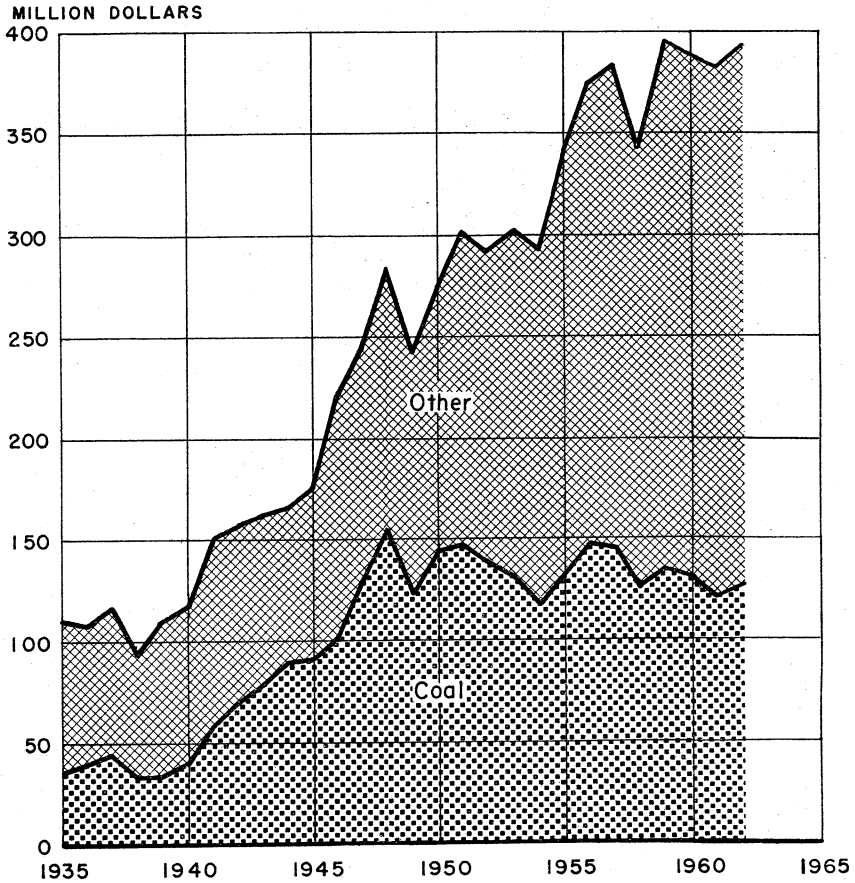

FIGURE 1.—Value of coal and total value of mineral production in Ohio 1935–62.

In the Bureau of Mines Safety Competition, for sand and gravel plants, winners of Certificate of Achievement in Safety were:

American Aggregates Corp., Columbus
American Aggregates Corp., Dayton
The Standard Slag Co., Massillon
American Aggregates Corp., Newark
American Materials Corp., Hamilton
The Standard Slag Co., Mantua
The Marble Cliff Quarries, Columbus
The Standard Slag Co., Piketon

In the National Slag Association Safety Competition, winners of a Certificate of Achievement in Safety were:

Class A:
The Standard Slag Co., Cleveland
The Standard Slag Co., Mingo Junction
The Lorain Slag Co., Lorain
Class B:
The Standard Slag Co., Lordstown

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Output of abrasive stones (grindstones) decreased in tonnage but increased in value. Production came from two operations, one in Lorain County and one in Washington County. Production in Lorain County was as a coproduct of sandstone quarrying.

Cement.—Production and shipments of portland cement increased over that of 1961, but value decreased. Production, shipments, and value of masonry cement increased. The decline in value of portland cement was attributed to a lower average unit value which dropped from $3.48 in 1961 to $3.32. The average unit value of masonry cement also decreased. The number of active plants remained at 10, and kilns operated at 69 percent of capacity compared with 67 percent in 1961. Stocks at mills on December 31 were 85,000 barrels higher than at the end of 1961. In terms of value, Greene and Muskingum were the leading cement-producing counties; Lawrence County dropped from second to third place.

Over 4.3 million tons of limestone and cement rock were used to manufacture portland cement. In addition, the following quantities of other raw materials were used: Clay and shale, 622,000 tons; gypsum, 129,000 tons; sand and sandstone, 60,000 tons; and iron materials, 21,000 tons. The companies also used quantities of anhydrite, fluorspar, grinding aids, and air-entraining compounds. Types I–II (general use), Type III (high-early-strength), and waterproof portland cements were produced.

Portland cement was shipped to consumers in Ohio (69 percent), Indiana (10 percent), and West Virginia (8 percent). The remainder was shipped, in decreasing order of quantity, to Michigan, Kentucky, Pennsylvania, Illinois, Virginia, and New York. Most of the masonry cement was shipped to consumers in Ohio, Indiana, and West Virginia. Distribution of portland cement shipments, by types of customers, was as follows: Ready-mixed-concrete companies, 9.1 million barrels; highway and other contractors, 2.6 million barrels; concrete product manufacturers, 2.1 million barrels; and building material dealers, 1.4 million barrels. The remainder was shipped to Federal, State, and local government agencies and miscellaneous customers. Nearly 13 million barrels of portland cement was transported by truck, and the remainder by rail or it was used by the producers. Of the total shipments, 91 percent was in bulk and the remainder was in containers, mainly paper bags.

The annual finished-cement capacity of 22.4 million barrels on December 31 was unchanged. Sixty-nine percent of the total capacity was wet process, and 31 percent was dry process. Companies reported consuming 379.7 million kilowatt hours of electrical energy, of which 61 percent was purchased from public utility companies.

Clays.—Production of clay decreased compared with 1961, owing chiefly to decreased demand for heavy clay products and clay for cement manufacture. Clays for these uses declined 6 and 10 percent, respectively, below those of 1961. Output of refractory clay

for the steel, glass, and foundry industries, totaled 766,000 tons, 6 percent above that of 1961. In addition, production of clay for lightweight aggregate (expanded clay) also increased. Clay used for heavy clay products, cement, and refractories, supplied 92 percent of the total output. Fifty-three percent of the total was miscellaneous clay or shale; the remainder was fire clay used primarily in heavy clay products and refractories. Other uses of Ohio clay included pottery and stoneware, floor and wall tile, filler material, and rotary-drilling mud. Fire clay was produced in 17 counties, and Tuscarawas and Stark Counties led in output. Cuyahoga and Greene Counties ranked first and second, respectively, in output among the 40 miscellaneous-clay-producing counties.

TABLE 3.—Finished portland cement produced, shipped, and in stock

(Thousand barrels and thousand dollars)

Year	Number of active plants	Production	Shipments from mills		Stocks at mills Dec. 31
			Quantity	Value	
1953–57 (average)	9	14,365	14,039	$40,797	1,169
1958	10	15,191	14,960	50,092	2,115
1959	11	18,028	18,141	60,560	1,938
1960	11	16,850	16,752	58,470	1,962
1961	10	15,059	15,303	53,251	1,695
1962	10	15,465	15,353	51,006	1,780

TABLE 4.—Clays sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Carroll	68,801	$148,185	91,421	$154,249
Columbiana	318,311	(1)	359,121	(1)
Coshocton	1,500	1,875		
Cuyahoga	364,726	356,112	355,173	269,345
Delaware	57,431	84,077	(1)	(1)
Gallia	7,086	12,046	7,900	12,245
Hocking	34,372	106,729	15,337	46,012
Holmes	85,595	(1)	86,287	185,541
Jackson	98,597	(1)	90,967	(1)
Jefferson	127,067	819,121	140,449	930,398
Lawrence	179,055	749,272	209,564	751,342
Mahoning	(1)	(1)	157,135	(1)
Marion	116,070	145,088	112,940	141,175
Muskingum	(1)	109,536	(1)	79,477
Perry	269,673	732,843	245,936	701,701
Putnam	25,607	29,584	20,371	23,234
Scioto	(1)	53,567	7,130	35,027
Seneca	19,500	24,000	14,000	18,000
Stark	699,183	1,970,948	649,757	1,838,356
Summit	109,325	123,804	134,579	161,347
Tuscarawas	921,912	3,017,789	834,352	2,544,045
Van Wert	1,780	1,780	4,169	6,593
Wayne	103,245	94,334	99,283	89,668
Undistributed [2]	1,314,452	5,209,332	1,114,868	4,990,803
Total	4,923,288	13,790,022	4,750,739	12,978,563

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes data for the following counties: Ashland, Athens, Auglaize, Darke, Franklin, Greene, Hancock, Harrison, Henry, Highland, Lake, Lucas, Madison, Medina, Noble, Paulding, Portage, Richland Vinton, Williams, Wood (1961), and Wyandot; and data indicated by footnote 1.

Gem Stones.—Mines and quarries throughout the State continued to attract gem and mineral specimen collectors, but the value of minerals collected decreased compared with 1961. Specimens collected included calcite, celestite, flint, fossils, jasper, pyrite, and sphalerite. Coshocton, Muskingum, and Licking Counties were the areas attracting the greatest mineralogical interest.

Gypsum.—Production of crude gypsum from two underground mines in Ottawa County was virtually the same as in 1961; value increased slightly. The crude material was calcined at nearby plants for manufacturing finished building products. Gypsum also was calcined at a plant in Lorain County from crude material shipped from outside the State. Calcined gypsum production increased and totaled 296,00 tons valued at $4.6 million.

Iron Oxide Pigments.—Minnesota Mining & Manufacturing Co., Copley, Summit County, produced red iron oxide pigments, principally from pyrite cinder shipped from Delaware.

Lime.—Ohio continued as the Nation's leading lime producing State. Production and value increased primarily because of increased demand for chemical and industrial lime. Output of building, refractory, and agricultural lime was below that of 1961. However, average unit values were higher for all major categories of lime. Lime data for 1961 and 1962 reported in table 5 includes only primary lime production. Excluded from the data is regenerated quicklime produced in Montgomery and Ross Counties. Eighty-five percent of the total primary lime output was quicklime used mainly for chemical and industrial applications. Hydrated lime was used chiefly by the construction industry. Primary lime was produced at 22 plants in 14 counties. Sandusky County continued to lead in lime production, supplying 28 percent of the total quantity and 33 percent of the total value. Shaft kilns and continuous hydrators predominated at reporting plants. Anthracite and bituminous coal, coke, natural gas, producer gas, and carbon monoxide were used as fuels. Shipments of lime were made to consumers in the District of Columbia and 45 States, and exports were made to Canada, Mexico, and England.

TABLE 5.—Lime sold or used by producers, by uses

(Thousand short tons and thousand dollars)

Year	Agricultural (burned)		Building		Chemical and other industrial		Refractory		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	47	$615	560	$9,088	987	$8,667	1,264	$18,697	2,858	$37,067
1958	34	481	474	7,539	1,007	9,977	896	14,474	2,411	32,471
1959	31	427	492	9,249	1,563	17,484	1,104	17,961	3,190	45,121
1960	30	449	426	8,288	1,604	18,516	1,057	17,150	3,117	44,403
1961	27	381	399	7,400	[1] 1,615	[1] 17,864	1,007	15,621	[1] 3,048	[1] 41,266
1962	26	396	383	7,257	1,743	20,734	950	15,405	3,102	43,792

[1] Revised figure.

Perlite (Expanded).—Expanded perlite was produced at plants in Cuyahoga and Hamilton Counties from crude material shipped from Western States. The processed material was used for plaster and concrete aggregate, soil conditioner, insulation, and other purposes.

Salt.—Output of salt in Ohio reached a record high as production exceeded 4 million tons for the first time. Production and value increased 21 and 15 percent, respectively, over the previous high of 1961. Increased output for all categories of salt (rock and evaporated salt and brine) were recorded. The sharpest increase was in rock salt production because of continued development of the underground Cleveland mine of International Salt Co. and greater output of rock salt in Lake County. Evaporated salt was produced in Meigs, Summit, and Wayne Counties and brine in Lake and Summit Counties. Most of the evaporated salt was produced by the vacuum pan process and sold for a wide variety of uses; some was marketed as pressed blocks. Brine recovered from nearby wells was used chiefly by producers for manufacturing chlorine and soda ash. Most of the rock salt was used in chemicals and for melting snow and ice on highways. The productive capacity of the Ohio salt industry was expected to be 5.6 million tons in 1964 when the Cleveland mine was fully developed.

Sand and Gravel.—Although output of sand and gravel by Government-and-contractor operations dropped sharply, total tonnage and value increased 5 percent compared with 1961. Commercial production increased 6 percent, primarily because of greater demand for building and paving material. Commercial sand and gravel used in building and highway construction and maintenance totaled 29.6 million tons compared with 27.9 million tons in 1961. Output of industrial sand also increased and totaled 1.1 million tons valued at $4.3 million, 92,000 tons higher than in 1961. Major uses for industrial sand were for molding, glass manufacture, and furnace construction and repair.

The number of commercial operations increased, and production was reported in 71 counties. Output exceeding 1 million tons was reported by two operations, and five operations produced from 500,000 to 1 million tons. Over 32.3 million tons of sand and gravel was processed by commercial producers. Material was transported to consumers by truck (92 percent), rail (5 percent), and water (3 percent). Hamilton and Franklin Counties led with production exceeding 3.7 million tons. Montgomery, Butler, Stark, and Portage Counties, with more than 1.9 million tons each, were important sand and gravel producing counties. These 6 counties furnished 48 percent of the total State production.

Slag (Iron-Blast-Furnace).—Production of processed iron-blast-furnace slag in Ohio increased in contrast with the national output and totaled 5.8 million tons compared with 4.2 million tons in 1961. Value increased more than $3 million to $11.3 million. Eighty-six percent (80 percent in 1961) of the total processed slag was screened and air cooled; the remainder consisted of granulated and lightweight (expanded) slag. Most screened, air-cooled slag was used as aggregate for concrete and bituminous construction, highway and airport construction, and as railroad ballast. Slag was processed chiefly at the steelmaking centers of Cleveland, Middletown, and Youngstown. Ohio continued to rank second among the 16 slag-processing States and supplied 25 percent of the national output.

TABLE 6.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	5,773	$6,427	5,775	$6,416
Paving	6,198	6,363	7,152	7,258
Fill	778	649	673	531
Molding	341	1,269	383	1,451
Filtration	13	43	21	(1)
Fire or furnace	162	398	151	429
Other [2]	603	2,055	745	2,559
Total	13,868	17,204	14,900	18,644
Gravel:				
Building	5,265	6,597	5,628	6,965
Paving	10,679	13,038	11,045	13,535
Railroad ballast	53	39	(1)	(1)
Fill	716	588	1,035	677
Other	1,955	2,711	2,018	2,994
Total	18,668	22,973	19,726	24,171
Total sand and gravel	32,536	40,177	34,626	42,815
Government-and-contractor operations:				
Sand:				
Building	----------	----------	(3)	(4)
Paving	468	468	281	223
Fill	31	31	4	1
Total	499	499	285	224
Gravel:				
Building	2	2	(3)	1
Paving	649	593	285	291
Fill	2	1	(3)	(4)
Other	----------	----------	8	2
Total	653	596	293	294
Total sand and gravel	1,152	1,095	578	518
All operations:				
Sand	14,367	17,703	15,185	18,868
Gravel	19,321	23,569	20,019	24,465
Grand total	33,688	41,272	35,204	43,333

[1] Figures withheld to avoid disclosing individual company data; included with "Other."
[2] Includes the following sands: Glass, grinding and polishing, blast, engine, ferrosilicon, ground, and other; and data indicated by footnote 1.
[3] Less than 500 tons.
[4] Less than $500.

Stone.—Increase in total output of stone (limestone, sandstone, and calcareous marl) was attributed primarily to greater demand for limestone for aggregate. Demand for limestone for other major uses remained relatively stable. Limestone supplied 98 and 87 percent of the total stone tonnage and value, respectively. In addition to the major uses indicated in table 7, other uses of crushed limestone included paper and glass manufacture, whiting, asphalt and fertilizer filler, filter beds, stone sand, mineral food, poultry grit, and for controlling dust in coal mines. Output of dimension limestone declined; it was used in construction and in architectural applications.

Production of dimension and crushed sandstone increased. Most dimension sandstone was marketed as rough, sawed, and dressed architectural stone; some of the rough and sawed stone was used for lining steel-making furnaces. In addition, some dimension stone

was used in construction and as curbing and flagging. Crushed sandstone was produced for ganister (refractory), aggregate, riprap, glass and cement manufacture, and foundry and other uses.

Limestone was quarried in 55 counties. Sandusky, Erie, and Seneca Counties, each with production exceeding 2.2 million tons, led the State in output. Among the 13 counties producing sandstone, Scioto County led in value and Lorain County in tonnage. Output of calcareous marl for agricultural stone (agstone) increased in Darke County.

TABLE 7.—Crushed and broken limestone sold or used by producers, by uses

Use	1961		1962	
	Short tons	Value	Short tons	Value
Riprap	121,101	$168,841	224,614	$282,762
Concrete aggregate and roadstone	16,700,520	21,680,840	17,990,967	23,693,633
Fluxing stone	4,432,666	6,807,105	4,386,457	6,810,896
Agriculture	1,987,540	3,478,042	1,998,599	3,593,383
Railroad ballast	900,359	1,124,409	973,786	1,189,968
Cement	3,870,419	4,967,173	3,677,041	4,754,915
Lime	4,441,605	7,902,735	4,013,831	7,589,217
Miscellaneous uses	[1] 644,194	[1] 1,794,721	635,861	1,845,616
Total	33,098,404	47,923,866	33,901,156	49,760,390

[1] Revised figure.

Sulfur (Recovered Elemental).—Sun Oil Co. recovered elemental sulfur by catalytic oxidation of hydrogen sulfide at its Toledo refinery.

Vermiculite (Exfoliated).—Cleveland Builders Supply Co. produced exfoliated vermiculite at Cleveland; production was below that of 1961. Crude material shipped from Montana and the Republic of South Africa was processed for concrete and plaster aggregate, soil conditioner, loose fill insulation, and other uses.

MINERAL FUELS

Coal (Bituminous).—Reversing a 2-year downward trend, bituminous coal production increased by 1.9 million tons over that of 1961. A lower average value per ton ($3.72) was reported. Greater production was accompanied by an increase in the number of strip mines from 260 in 1961 to 266, and underground mines increased from 126 to 132. There continued to be 53 auger operations. Strip mines supplied 69 percent of the total production; underground mines, 27 percent; and auger operations, 4 percent.

Production at strip mines increased by nearly 1 million tons and totaled 23.4 million tons. Strip mines were operated in all 25 coal-producing counties. Harrison, Belmont, Jefferson, and Morgan Counties supplied 51 percent of the total strip mine production. Average value per ton of coal from strip mines decreased from $3.57 in 1961 to $3.51. Equipment used in mining and loading operations included 44 electric, 42 diesel-electric, 429 diesel, and 65 gasoline powered shovels or dragline excavators. Sixty-two percent of this equipment had dipper capacities of less than 3 cubic yards, and 25 percent had capacities over 12 cubic yards. In addition, 493 bulldozers, 45 carryall scrapers, and 176 power drills were used at strip mines.

Underground mine production totaled 9.3 million tons, 10 percent higher than in 1961. Mines were active in 17 counties, and Belmont and Harrison Counties furnished 75 percent of the underground production in Ohio. The average value per ton of coal mined underground decreased from $4.39 in 1961 to $4.34. Sixty-one percent of the underground output was cut by machines and 38 percent by continuous mining machines. Of the underground production, 93 percent was mechanically loaded. The number of continuous mining machines increased by 2 to 37; output increased from 3.1 million tons in 1961 to 3.6 million tons.

Compared with 1961, recovery of coal by auger mining increased 8 percent and totaled 1,349,000 tons. Average value per ton increased from $3.12 to $3.18. Auger tonnage was reported in 15 counties, and Noble and Jefferson Counties furnished 34 percent of the State total.

Coal was cleaned at 20 preparation plants, 1 less than in 1961. Over 13.1 million tons of coal was cleaned compared with 14.5 million tons in 1961. Coal was cleaned by jigs (56 percent), by wet-washing other than jigs (41 percent), and by pneumatic methods (3 percent). Over 11.4 million tons was crushed, and 2.2 million tons was treated with dust-allaying materials and antifreezing materials. Transportation from tipple to consumer was by rail or water (52 percent), truck (35 percent), and by other means, mainly pipeline, (13 percent). Production of coal by captive operations decreased and totaled 4.3 million tons.

TABLE 8.—Bituminous coal production

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	36,174	$135,519	1960	33,957	$130,877
1958	32,028	126,241	1961	32,226	121,343
1959	35,112	135,729	1962	34,125	127,051

Coke and Coal Chemicals.—Coke production increased 2 percent and totaled 6.8 million tons valued at $113.5 million. Ohio continued to rank third among the 20 oven-coke-producing States. In contrast with the national average which increased by 34 cents, the average value per ton of Ohio coke decreased from $16.84 in 1961 to $16.57. Quantity of bituminous coal carbonized totaled 9.8 million tons. The coke yield decreased from 70.01 percent in 1961 to 69.95 percent.

Fifty percent of the coking coal delivered to Ohio plants came from West Virginia, 39 percent from Pennsylvania, 6 percent from Virginia, and 5 percent from Kentucky. Seventy-six percent of the coal received was high-volatile, 22 percent low-volatile, and 2 percent medium-volatile. At yearend, 12 plants operated 1,820 slot-type ovens, 2 less plants and 593 fewer ovens than in 1961. Eighty-five percent (90 percent in 1961) of the coke produced was consumed by producing companies, largely in blast furnaces. Sales were to other industrial consumers and for residential heating.

Coke breeze production decreased by 7 percent to 407,000 tons valued at $2.7 million. Producing companies used 205,000 tons of coke breeze

in steam plants, agglomerating plants, and for other industrial uses; over 168,000 tons was sold. Coke products at plants included coke-oven gas (97.9 billion cubic feet), ammonium sulfate (88,000 tons), and coke-oven tar (85.4 million gallons). Most of the tar was sold for further refining into tar products; the remainder was used by producers for refining or topping and as fuel. Over 26.8 million gallons of crude light oil was recovered at 11 plants from which 12.4 million gallons of benzene, 2.8 million gallons of toluene, 695,000 gallons of xylene, and 484,000 gallons of solvent naphtha were derived.

Fuel Briquets and Packaged Fuel.—Shipments of fuel briquets into Ohio from other States totaled 31,000 tons compared with 33,000 tons in 1961. Production and shipments of packaged fuel was 1,274 tons valued at $27,000, 15 and 17 percent, respectively, lower than in 1961. The average unit price decreased and was well below the national average of $22.83. Packaged fuel producers were Ackerman Coal Co., Toledo; Air City Fuels, Inc., Dayton; Bartak Coal Co., Maple Heights; Pacific Coal & Supply Co., Cleveland; and Ralph Coal & Supply Co., Toledo.

Peat.—Shipments of peat decreased 19 percent, and the number of active operations decreased from 15 in 1961 to 12. The average value per ton increased from $13.48 in 1961 to $14.32. Most of the output was sold in bulk, and 15 percent was sold in packages. Of the eight counties producing peat, Wyandot lead in value.

Petroleum and Natural Gas.—Although production of petroleum decreased and natural gas increased only 1 percent, the year was highlighted by increased drilling activity. Well completions were the highest since 1955 and totaled 1,210 wells compared with 1,131 in 1961. Total footage drilled was 2,955,000, and average footage dropped from 2,507 in 1961 to 2,442. Wildcat completions totaled 100 (11 oil, 10 gas, and 79 dry), nearly double those of 1961. Exploratory wells were drilled in 46 counties; Morrow with 14 wells and Marion and Washington, each with 8 wells, were the principal drilling areas. Most of the oil and gas wildcat wells were drilled to depths of 1,250 to 5,000 feet; one gas discovery was located at the 7,500- to 10,000-foot depth. Most of the dry holes were drilled to depths of 2,500 to 3,750 feet, and none went below 7,500 feet.

A total of 1,110 development completions (557 oil, 251 gas, 205 dry, and 97 service) were reported, 32 more than in 1961. Among the 42 counties with development completions, Washington led with 123 followed by Ashland (117) and Hocking (102). Most of the field wells were drilled to depths of 2,500 to 3,750 feet. Eighty-seven percent of the total well completions were drilled with cable tools, compared with the national average of 16 percent.[3]

Proved reserves on December 31, according to American Petroleum Institute and American Gas Association were petroleum, 77.3 million barrels and natural gas, 731,875 million cubic feet (14.65 pounds per square inch absolute, at 60° F). The proved reserves of petroleum increased by 1.6 million barrels, and natural gas reserves decreased by 1,962 million cubic feet. According to the Oil and Gas Section, Ohio Division of Geological Survey, there were 16,867 oil and 7,117 gas producing wells on December 31.

[3] Oil and Gas Journal. V. 61, No. 4, Jan. 28, 1963.

Total crude oil capacity of active petroleum refineries at yearend was 467,100 barrels per day, slightly higher than in 1961. Gasoline capacity at operating plants was 178,000 barrels per day compared with 175,000 barrels in 1961. Fifty-eight percent of the total was cracking capacity, the remainder represented reforming capacity. Operating refineries were Ashland Oil & Refining Co., Canton and Findlay; Pure Oil Co., Newark and Toledo; the Standard Oil Co. (Ohio), Cleveland, Lima, and Toledo; American Bitumuls & Asphalt Co., Cincinnati; Gulf Oil Corp., Cleveland and Toledo; Sun Oil Co., Toledo, and Sea-Way Oil Refining Co., Weston.

METALS

Aluminum.—Production and value of primary aluminum was virtually the same as in 1961. Ormet Corp., owned jointly by Olin-Mathieson Chemical Corp. and Revere Copper & Brass, Inc., produced aluminum at Omal near Hannibal. The company reduced alumina produced at its Burnside, La., plant from Surinam bauxite. The alumina was shipped by river barge from Louisiana. Annual capacity at the reduction plant remained 180,000 tons. Olin-Mathieson started an expansion program at its aluminum rolling mill adjacent to the reduction plant. Expanded rolling facilities were scheduled for completion in 1963.

Beryllium.—The Brush Beryllium Corp. produced beryllium metal, alloys, and compounds at Elmore. Most of the output was beryllium metal and beryllium-copper alloys. The company reported sales of $22.6 million compared with $26 million in 1961. On November 30, the 5-year contract for annual delivery of 37,500 pounds of nuclear-grade beryllium between the company and the U.S. Atomic Energy Commission (AEC) was completed. Delta Star Electric Division, H. K. Porter Co., Lisbon, also consumed beryl for manufacturing high-voltage suspension insulators.

Ferroalloys.—Production of ferroalloys totaled 546,000 tons, a 16 percent increase over that of 1961. However, shipments and value declined 1 and 11 percent, respectively, and totaled 538,000 tons valued at $120.4 million. Ohio continued to lead in production, supplying 29 percent of the national output and 31 percent of the value. Fifteen principal classifications of ferroalloys were produced. No ferroboron or aluminum silicon alloys were produced, but shipments were made from stocks. Ferromanganese, silicomanganese, silvery pig iron, ferrosilicon, and ferrochromium and chromium briquets represented 98 percent of the tonnage and 92 percent of the value of all ferroalloys shipped from plants. Of the five major ferroalloys, shipments increased for all but silvery pig iron and ferrochromium and chromium briquets. All but silvery pig iron had lower average unit values compared with 1961.

Iron and Steel.—Steel production increased 2 percent over that of 1961 and totaled 16.8 million tons, according to American Iron and Steel Institute. Eighty-one percent of the total was produced in open hearth furnaces compared with 86 percent in 1961, reflecting increasing use of the basic oxygen process at Ohio steel plants. The State continued to rank second in steel production and supplied 17 percent of the national output. Production of pig iron was 11.5 million tons, 5 percent greater than in 1961. Shipments totaled 11.5

TABLE 9.—Ferroalloy producers in 1962

Company	Location	Type of furnace	Ferroalloys produced [1]
Interlake Iron Corp.	Beverly	Electric	SiMn, FeSi, FeCr.
Do.	Jackson	Blast	Silvery pig iron.
Do.	Toledo	do.	Do.
Jackson Iron & Steel Co.	Beverly	do.	Do.
Ohio Ferro-Alloys Corp.	Brilliant	Electric	FeSi, FeCr.
Do.	Philo	do.	FeMn, SiMn, FeSi, other miscellaneous ferroalloys.
Do.	Powhatan Point	do.	FeSi, Si.
Union Carbide Metals Co.	Marietta	do.	FeMn, SiMn, FeSi, FeCr, spiegeleisen, other miscellaneous ferroalloys.
Do.	Ashtabula	do.	FeMn, SiMn, FeSi.
Vanadium Corporation of America.	Vancoram	do.	FeCr, FeSi.
Do.	Cambridge	do.	FeMn, FeTi, FeV, FeB, FeCb, other miscellaneous ferroalloys.

[1] Symbols used: FeMn, ferromanganese; SiMn, silicomanganese; FeSi, ferrosilicon; FeCr, ferrochromium FeTi, ferrotitanium; FeB, ferroboron; FeCb, ferrocolumbium; FeV, ferrovanadium; Si, silicon.

million tons valued at $686.9 million. Yearend stocks were higher than in 1961. Basic, Bessemer, malleable, foundry, low-phosphorous, direct-casting, and other pig iron was produced at 16 active plants having 45 blast furnaces. The Massillon blast furnace of Republic Steel Corp. was idle. Sharon Steel Corp. abandoned its Lowellville plant. At active plants, 9 of the 45 blast furnaces were out of blast for the entire year. Over 9.3 million tons of basic and 1.5 million tons of Bessemer pig iron were produced.

Domestic iron ore shipments to plants decreased 6 percent, and foreign iron ore shipments increased 33 percent. Over two-thirds of the foreign ore came from Canada and Labrador and the remainder from Chile, Brazil, Venezuela, and Liberia. Nearly 1.9 million tons of foreign iron ore was consumed in blast furnaces, 9 percent more than in 1961. Domestic ore consumed in blast furnaces decreased 21 percent and totaled 5.5 million tons. Tonnages of other materials consumed in blast furnaces were limestone and dolomite, 3 million; mill cinder and roll scale, 637,000; open hearth, basic oxygen, and Bessemer slag, 616,000; coke and coke breeze, 8.2 million; home and purchased scrap, 811,000; slag scrap, 198,000; sinter (regular), 4.6 million; pellets (regular), 5.3 million; and foreign agglomerates, 195,000. In addition, domestic and foreign manganiferous ore, flue dust, and other materials were used in producing pig iron. At agglomerating plants, 1.3 million tons of domestic iron ore, 1.6 million tons of foreign ore, 1 million tons of flue dust, and quantities of limestone and dolomite, mill cinder and roll scale, slag, coke breeze, and anthracite were used to produce sinter. Slag and scrap produced at blast furnaces totaled 4.5 million tons and 158,000 tons, respectively. Recovered materials included 824,000 tons of flue dust.

Lead and Zinc Pigments.—Black lead oxide pigments were produced at Cleveland by Willard Storage Battery Co. E. I. du Pont de Nemours & Co., Inc., manufactured zinc chloride pigments. Zinc oxide pigments were manufactured at Columbus by American Zinc Oxide Co.

Titanium.—U.S. Industrial Chemicals Co. (USI) produced titanium sponge by sodium reduction of titanium tetrachloride at Ashtabula. Bridgeport Brass Co. (Reactive Metals Products), Niles, and Republic Steel Corp., Massillon and Canton, melted titanium. These

companies produced and processed ingots into mill products including bars, billets, plate, sheet, and strip. Titanium Metals Corporation of America (TMCA), Toronto, rolled and fabricated titanium metal. The company completed construction of a $2 million plant to produce seamless, welded, and redrawn titanium tubing. TMCA also announced plans to construct a $14 million continuous rolling mill at Toronto. Included in the expansion program, in addition to the hot rolling mill to produce titanium sheets and strip up to 48 inches in width, were electrolytic pickling facilities and a continuous vacuum-annealing furnace. TMCA, owned jointly by Allegheny Ludlum Steel Corp. and National Lead Co., used primary metal shipped from the company's reduction plant at Henderson, Nev.

The Ruberoid Co. with Cabot Corp. of Boston, Mass., formed a joint company to produce titanium dioxide at Ashtabula. Construction was started on the first 20,000-ton production unit, and it was expected to be in operation by the end of 1963. Initial plans called for expansion to 40,000 tons per year. The new company, known as Cabot Titania Corp., and owned two-thirds by Cabot and one-third by Ruberoid, would utilize the titanium dioxide flame process developed by Cabot in association with Fabriques de Produits Chimiques de Thann et de Mulhouse of France.[4]

Zirconium.—Hafnium-free zirconium sponge was produced at Ashtabula by Reactive Metals Inc. The company also produced zirconium ingot at Niles. Chas. Taylor Sons Co., Cincinnati, produced zircon and zirconia refractories. Union Carbide Metals Co., Ashtabula, and Vanadium Corporation of America, Cambridge, produced zirconium ferroalloys. High-purity zirconium oxide was produced at Elyria by Harshaw Chemical Co.

REVIEW BY COUNTIES

Mineral production was reported in all but 1 (Fulton) of the 88 counties in Ohio. Increased values were reported in 47 counties. Harrison, Belmont, Lake, and Summit Counties accounted for over $100 million of the State's total value and continued to be the leading mineral-producing counties. In addition, value of mineral output exceeding $10 million was recorded for eight other counties. Thirty-six other counties produced values over $1 million. Production of Government-and-contractor sand and gravel was reported in 10 counties compared with 15 in 1961. Detail by county on petroleum and natural gas operations was not available.

Adams.—Davon, Inc., produced limestone at its Plum Run quarry near Peebles. The stone was crushed and sized for use as aggregate, roadstone, blast-furnace flux, agstone, and railroad ballast. Finely ground limestone was sold for coal mine dusting.

Allen.—Limestone production increased slightly over that of 1961. Producers were National Lime & Sand Co., Western Ohio Stone Co., both near Lima; Suever Stone Co., Delphos; and Bluffton Stone Co., Bluffton. Wapack Sand & Gravel Co. at its No. 6 plant near South Westminster produced building and paving sand and gravel.

[4] The Ruberoid Co. 1962 Annual Report.

TABLE 10.—Value of mineral production in Ohio, by counties[1 2]

County	1961	1962	Minerals produced in 1962, in order of value
Adams	[3] $597,857	$787,526	Stone.
Allen	916,915	897,184	Stone, sand and gravel.
Ashland	(4)	(4)	Sand and gravel, clays.
Ashtabula	(4)	(4)	Lime, sand and gravel.
Athens	1,961,192	1,814,440	Coal, stone, clays, sand and gravel.
Auglaize	(4)	(4)	Stone, sand and gravel, clays.
Belmont	(4)	27,105,589	Coal, stone.
Brown	42,439	53,225	Stone, sand and gravel.
Butler	2,416,545	2,196,686	Sand and gravel.
Carroll	1,964,036	1,375,307	Coal, clays, stone, sand and gravel.
Champaign	296,262	(4)	Sand and gravel, stone.
Clark	(4)	(4)	Sand and gravel, lime, stone.
Clermont	564,674	683,820	Sand and gravel.
Clinton	615,690	482,106	Stone, sand and gravel.
Columbiana	6,424,785	6,054,774	Coal, clays, sand and gravel.
Coshocton	9,351,327	8,880,000	Coal, stone, sand and gravel, gem stones.
Crawford	(4)	(4)	Stone, sand and gravel.
Cuyahoga	2,480,534	3,888,703	Lime, sand and gravel, salt, clays.
Darke	(4)	(4)	Sand and gravel, clays, peat, stone.
Defiance	(4)	(4)	Sand and gravel.
Delaware	[3] 996,207	1,092,466	Stone, lime, clays, sand and gravel.
Erie	3,392,317	3,222,849	Stone, sand and gravel.
Fairfield	342,390	326,014	Sand and gravel.
Fayette	738,510	1,094,565	Stone, sand and gravel, gem stones.
Franklin	[3] 7,470,649	8,423,865	Sand and gravel, stone, lime, clays, peat.
Gallia	2,673,967	3,175,399	Coal, sand and gravel, stone, clays.
Geauga	(4)	(4)	Sand and gravel, stone.
Greene	(4)	(4)	Cement, stone, sand and gravel, clays.
Guernsey	939,853	1,232,441	Coal, stone.
Hamilton	5,372,322	6,082,657	Sand and gravel, stone.
Hancock	(4)	(4)	Stone, sand and gravel, clays, lime.
Hardin	(4)	(4)	Stone.
Harrison	30,923,621	31,878,261	Coal, stone, clays.
Henry	(4)	(4)	Sand and gravel, clays.
Highland	(4)	(4)	Stone, sand and gravel, clays.
Hocking	319,551	325,935	Coal, clays, sand and gravel.
Holmes	1,200,802	1,345,271	Coal, stone, clays, sand and gravel.
Huron	(4)	(4)	Sand and gravel, peat.
Jackson	1,936,054	1,961,717	Coal, clays, stone.
Jefferson	12,113,369	12,352,897	Coal, clays.
Knox	(4)	(4)	Sand and gravel, stone.
Lake	(4)	(4)	Salt, lime, cement, sand and gravel, clays, stone
Lawrence	[3] 11,498,529	10,911,194	Cement, coal, stone, clays, sand and gravel.
Licking	661,538	780,723	Sand and gravel, gem stones.
Logan	398,832	413,389	Stone, sand and gravel.
Lorain	(4)	(4)	Stone, sand and gravel, abrasives.
Lucas	(4)	(4)	Cement, stone, sand and gravel, clays.
Madison	(4)	(4)	Sand and gravel, stone, clays.
Mahoning	(4)	(4)	Coal, stone, clays, sand and gravel, peat.
Marion	(4)	(4)	Stone, clays, sand and gravel.
Medina	(4)	(4)	Sand and gravel, clays.
Meigs	(4)	(4)	Sand and gravel, coal, salt.
Mercer	(4)	(4)	Stone, sand and gravel.
Miami	(4)	(4)	Do.
Monroe	213,722	(4)	Sand and gravel.
Montgomery	[3] 3,970,157	3,278,153	Sand and gravel, stone.
Morgan	(4)	(4)	Coal, sand and gravel, stone.
Morrow	64,900	53,260	Sand and gravel.
Muskingum	(4)	(4)	Cement, stone, coal, sand and gravel, clays, gem stones.
Noble	(4)	(4)	Coal, stone, clays.
Ottawa	[3] 6,578,199	6,404,574	Lime, stone, gypsum, gem stones.
Paulding	(4)	(4)	Cement, stone, clays.
Perry	(4)	(4)	Coal, sand and gravel, clays, stone.
Pickaway	(4)	(4)	Sand and gravel.
Pike	715,660	942,144	Sand and gravel, stone.
Portage	3,481,249	3,659,136	Sand and gravel, stone, coal, clays, peat.
Preble	(4)	(4)	Lime, sand and gravel, stone.
Putnam	399,105	454,323	Stone, lime, clays.
Richland	(4)	(4)	Sand and gravel, clays, peat.
Ross	(4)	(4)	Sand and gravel, stone.
Sandusky	[3] 19,000,072	18,565,060	Lime, stone, sand and gravel.
Scioto	(4)	(4)	Stone, clays, sand and gravel.
Seneca	(4)	(4)	Lime, stone, clays.
Shelby	552,615	386,871	Sand and gravel, stone.
Stark	[3] 13,113,770	12,144,175	Cement, sand and gravel, coal, clays, stone, peat.
Summit	(4)	(4)	Salt, lime, cement, stone, sand and gravel, clays.
Trumbull	209,453	(4)	Sand and gravel.
Tuscarawas	12,202,852	12,051,744	Coal, clays, sand and gravel, stone.
Union	(4)	(4)	Stone, sand and gravel.

See footnotes at end of table.

TABLE 10.—Value of mineral production in Ohio, by counties [1] [2]—Continued

County	1961	1962	Minerals produced in 1962, in order of value
Van Wert	(4)	(4)	Stone, clays.
Vinton	$807,117	$521,894	Coal, stone, clays.
Warren	733,358	932,160	Sand and gravel, stone.
Washington	(4)	(4)	Coal, sand and gravel, abrasives.
Wayne	(4)	(4)	Salt, sand and gravel, stone, coal, clays.
Williams	(4)	(4)	Sand and gravel, clays.
Wood	(4)	732,062	Stone.
Wyandot	(4)	(4)	Stone, lime, sand and gravel, peat, clays.
Undistributed [5]	[3] 211,797,781	194,706,119	
Total	[3] 382,451,000	393,671,000	

[1] Fulton County not listed as no production was reported.
[2] Natural gas and petroleum values are not listed by counties as data are not available; included with "Undistributed."
[3] Revised figure.
[4] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[5] Includes natural gas and petroleum, some gem stones, and sand and gravel (1961) that cannot be assigned to specific counties, and values indicated by footnote 4.

Ashland.—Commercial sand and gravel was produced principally by Young's Sand & Gravel Co., Loudonville; Bolin & Son, Ashland; and Charles Bucklew, Polk. Output of sand and gravel by Government-and-contractor operations increased and totaled 19,000 tons. The E. Biglow Co. mined shale near New London for manufacturing heavy clay products.

Ashtabula.—Quicklime was produced at Ashtabula for metallurgical and chemical uses. Output of sand and gravel decreased and was recovered by Gleason Sand & Gravel Inc., Peerless Mineral Products Co., both near Conneaut; Northeast Materials Inc., Kingsville; and Carter Sand & Gravel Co., Ashtabula. Most of the material was processed for use in construction and paving. Some molding sand was produced at Conneaut.

Athens.—Output of coal was 1 percent below that of 1961. Fourteen mines (10 underground, 3 strip, 1 auger) were active, compared with 11 underground, 2 strip, and 2 auger in 1961. Gem Coal Co. continued to operate the only cleaning plant in the county. Diamond Stone Quarries, Inc., Shamrock Quarry Inc., both near Albany, and Ball & Ball, Amesville, produced limestone. All three companies improved plant facilities by installing new equipment. Plastic fire clay was recovered from pits near Nelsonville and Haydenville for Natco Corp. Output was used for manufacturing building brick and heavy clay products. Sand and gravel was produced by The F. H. Brewer Co., Lancaster; Athens Sand & Gravel Co., Athens; and Slater Sand & Gravel, The Plains.

Auglaize.—Limestone for aggregate, roadstone, agstone, and railroad ballast was produced at the Buckland quarry of National Lime & Stone Co. Structural and paving sand and gravel was produced by Wapak Sand & Gravel Co., Western Ohio Stone Co., and Quality Sand & Gravel and Ready Mix Co., all near Wapakoneta. Bank run material for paving was produced near Jackson Center. Sandkuhl Tile Co. mined clay near Spencerville for manufacturing heavy clay products.

Belmont.—The county continued to rank second in coal production. Output totaled 6.6 million tons, 22 perecnt more than in 1961. Most of the increase was in strip-mined coal. Thirty-seven mines (21 strip,

13 underground, and 3 auger) were active. Five cleaning plants operated, one less than in 1961, and processed 2.1 million tons of coal. In addition, 1.7 million tons were crushed and 254,000 tons were treated with calcium cholride or oil. Limestone was produced by Somerton Crushing Co., Somerton, and McCort Bros. (formerly George & C. H. McCort), Barnesville.

Brown.—The Brown County Highway Department produced limestone for aggregate, agstone, and other uses. Sand was recovered from the Georgetown pit of Howard S. Watson.

Butler.—The county continued to rank fourth in sand and gravel production. Commercial output from 13 plants totaled 2 million tons valued at $2.2 million. Principal operators included American Materials Corp. (two plants), Middletown Sand & Gravel Co., Ohio Gravel Co., Moorman Sand & Gravel Co., and Ross Gravel Corp. (formerly Ed & Joe's Gravel Pit).

Carroll.—Output of coal decreased 33 percent from that of 1961 and totaled 353,000 tons. Eighteen mines (5 underground, 11 strip, and 2 auger) were active compared with 19 in 1961. Clay, mostly in the form of miscellaneous clay and shale, was recovered from nine pits, six near Magnolia, two near Waynesburg, and one near Mineral City. Dimension sandstone was produced at Sherrodsville by Rainbow Stone Co. The Carrollton limestone quarry of Alan Stone Co., Inc., was idle during 1962. Mineral City Sand Co. produced molding and other sand at Mineral City.

Champaign.—Sand and gravel was produced by American Aggregates Corp., Miller's Excavating Service, both near Urbana, and Walter Dorsey, Springhill. Output was processed mainly for building and paving, railroad ballast, and as fill material. The Ohio State Highway Department produced limestone for highway maintenance.

Clark.—The Moores Lime Co. mined limestone at Springville for use as blast-furnace flux, aggregate, agstone, and raw material for manufacturing lime and dead-burned dolomite. The company produced quicklime and hydrated lime for construction, agriculture, and a variety of industrial uses. Output was shipped to 24 States and to Canada. Output of sand and gravel totaled 572,000 tons, 15 percent below that of 1961. Production consisting chiefly of processed material for construction was reported by nine companies. Principal producers included American Aggregates Corp., Fairborn; and Springfield Sand & Gravel Co. and Eagle City Sand & Gravel Co., both near Springfield.

Clermont.—Ohio Gravel Co. produced and processed sand and gravel at its Miamiville plant. The Johnson quarry near Felicity was idle.

Clinton.—Melvin Stone Co., Melvin, produced limestone for aggregate, flux, agstone, riprap, and stone sand. The company also processed structural sand and gravel at a stationary plant near Sligo. Clinton Gravel Co., Wilmington, produced paving and fill material.

Columbiana.—Coal production decreased 9 percent from that of 1961 and totaled 1.1 million tons. Thirty-eight mines (30 strip, 5 auger, and 3 underground) were active compared with 41 in 1961. The county continued to rank as an important clay-producing area. Clay, mostly fire clay, was recovered from six operations mainly near the eastern part of the county. Sand and gravel was recovered from three operations near Leetonia, and one each near Salem and Hanoverton.

Coshocton.—Coal production totaled 1.8 million tons, 9 percent below that of 1961. Twenty mines (8 underground, 10 strip, and 2 auger) were active, compared with 18 mines in 1961. Coal was crushed at nine mines, and output totaled 598,000 tons. Briar Hill Stone Co. operated seven sandstone quarries, and output consisted of sawed architectural stone. Variegated Quarries Division, Nicholl Stone Co., also quarried sandstone for architectural applications. The stone was processed at Killbuck, Holmes County. New Castle Lime Co. did not produce any agricultural limestone or clay at Wahonding. Sand and gravel output totaled 488,000 tons compared with 387,000 tons in 1961. Production consisted chiefly of processed construction material. Principal producers were Miller Gravel Co., Inc., W. P. McCarren Co. (two plants), and Boyd Gravel Co. Mineral specimens collected in the county were blue flint, jasper agate, and black jasper.

Crawford.—Limestone produced at the Spore quarry by National Lime & Stone Co., Bucyrus, was crushed for use as aggregate, agstone, railroad ballast, and metallurgical stone. Limestone also was produced under contract for the Crawford County Highway Department for road construction and maintenance. Galion Gravel Co., Galion, produced sand and gravel for building, paving, and fill.

Cuyahoga.—Cuyahoga Lime Co., Cleveland, produced metallurgical quicklime for use at nearby steel mills. Limestone shipped by boat from Michigan was burned in four shaft kilns. International Salt Co. continued developing its new underground salt mine at Cleveland. Development underground consisted of drifting and crosscutting. The company also increased the capacity of its salt preparation plant. Commercial production of sand and gravel decreased from 786,000 tons in 1961 to 696,000, and output by Government-and-contractor operations increased. Nine commercial operations, most of them near Cleveland, were active. Miscellaneous clay and shale were produced at six operations, and output was used primarily for manufacturing building brick and lightweight aggregate. Cleveland Gypsum Co. produced expanded perlite from crude material shipped from Colorado and Nevada.

Darke.—Sand and gravel production increased, most of the material being used for paving. The Fort Jefferson plant of American Aggregates Corp. was the principal producer. Darke County Tile Co., Greenville, and R. E. Clark, Versailles, mined clay for manufacturing drain tile. Lakeland Valley Organic Products (Woodrow Gary) produced calcareous marl for agstone at New Madison. Louie Meyer produced humus peat near Woodington.

Defiance.—Sand and gravel was produced by Ohio Materials, Inc., Hicksville, and Northwest Materials, Inc., Defiance.

Delaware.—Limestone was produced by Marble Cliff Quarries Co., Powell; The Owens Stone Co., Ostrander; Penry Stone Co., Radner; and National Lime & Stone Co., Delaware. Output consisted chiefly of stone for aggregate and agstone. Scioto Lime & Stone Co. produced quicklime and hydrated lime at Delaware. Most of the lime was used in water purification and for sewage treatment. Shale for manufacturing building brick was produced by Delaware Clay Co., Westerville, and Galena Shale Tile & Brick Co., Galena. Output of sand and gravel was reported by commercial and Government-and-contractor operations.

Erie.—Limestone was produced by Castalia Quarries Co., Castalia; Sandusky Crushed Stone Co., Inc., Parkertown; and Wagner Quarries Co., Sandusky. Output was crushed for use as aggregate, railroad ballast, and agstone. Sandusky Crushed Stone Co., Inc., installed a larger conveyor belt at its Parkertown plant. Medusa Portland Cement Co. discontinued shipments of finished portland cement from its Bay Bridge plant. The company had converted the plant into a distributing facility. Foundry sand was produced by Ohio Foundry Sand Co., Shinrock, and Keener Sand & Clay Co., Huron. Output was higher than that of 1961.

Fairfield.—Output of sand and gravel decreased 8 percent from that of 1961. Production was reported from six companies, and F. H. Brewer Co. and Febus Gravel Co. (formerly Sugar Grove Sand & Gravel Co.), both near Lancaster, were the leading producers. The material was used chiefly for concrete construction and highways.

Fayette.—Limestone output totaled 660,000 tons compared with 544,000 tons in 1961. Producers were Blue Rock, Inc., Greenfield, and Fayette Limestone Co., Inc., and Sugar Creek Stone Quarry Inc., both near Washington Court House. Output consisted chiefly of aggregate and agstone. Commercial sand and gravel production was reported in the county. Mineral specimens collected in the county were sphalerite and pyrite crystals.

Franklin.—Marble Cliff Quarries Co., Columbus, produced limestone for a variety of uses and quicklime and hydrated lime at its nearby plant. The Claycraft Co. and The Columbus Clay Manufacturing Co., both near Blacklick, produced shale for manufacturing heavy clay products. Operations at the Claycraft Co. were curtailed during February because of a labor dispute. Commercial sand and gravel output totaled 3.8 million tons, 16 percent above that of 1961. Fourteen operations, most of them near Columbus, were active. American Aggregates Corp. (three plants) and Miller Sand & Gravel were the leading producers. W. C. Utzinger & Sons produced reed-sedge peat near Grove City.

Gallia.—Output of coal totaled 760,000 tons, an increase of 4 percent over that of 1961. The 22 mines remained active. Construction sand and gravel and blast sand were produced at Gallipolis by M. T. Epling Co. Molding and foundry sand were produced by Keener Sand & Clay Co., Kerrs. Limestone was produced near Gallipolis. Jess Brammer mined shale near Waterloo for floor and wall tile.

Geauga.—Construction and industrial sand, including ground sand, was produced at Thompson by R. W. Sidley, Inc. Other construction sand and gravel was produced near Aurora, Chester, Newbury, Novelty, and Parkman. Quartzite for refractory brick was produced at Thompson by Harbison-Walker Refractories Co.

Greene.—The county continued in first place in cement production. Producers were Southwestern Portland Cement Co. and Universal Atlas Cement Division of United States Steel Corp., both near Fairborn. Both companies mined limestone and clay and Universal also mined sand as raw materials for cement. Types I–II (general use) and Type III (high-early-strength) portland cement and masonry cement were made by both companies. Southwestern also manufactured waterproof cement. Finished cement was shipped principally to consumers in Ohio, Indiana, and Kentucky. Blue Rock, Inc.,

produced limestone for concrete aggregate and roadstone at its newly developed quarry near Cedarville. Sand and gravel output totaled 939,000 tons, a considerable increase from the 1961 production of 692,000 tons. Ten operations were active and the principal producers were Hilltop Concrete Corp., Fairborn, and Phillips Sand & Gravel Co., Alpha.

Guernsey.—Coal production increased sharply and totaled 278,000 tons, compared with 190,000 tons in 1961. The number of active mines decreased from 11 to 9. Coal was cleaned by wet washing at the Carol No. 2 plant of Virginia Mining Co. John Gress & Sons, Inc., New Concord, produced limestone for aggregate and roadstone.

Hamilton.—The county continued as the leading sand and gravel producing county. Commercial production totaled 4.5 million tons compared with 3.6 million tons in 1961. Output by Government-and-contractor operations decreased and totaled 183,000 tons. Thirteen principal commercial operations, most of them near Cincinnati, were active. Ohio Gravel Co., with plants at Camp Dennison, Cleves, Miamitown, and Newtown, was the leading producer. Limestone used for agstone was recovered as a byproduct of sand and gravel production at the Newtown and Camp Dennison plants of Ohio Gravel Co. Philip Carey Manufacturing Co. produced expanded perlite at Cincinnati from crude material shipped from Colorado. The material was used for insulation.

Hancock.—Limestone used chiefly for aggregate was produced by National Lime & Stone Co. and Tarbox-McCall Stone Co., both near Findlay, and Pifer Stone Co., Williamstown. Sand and gravel for construction and filter beds was produced by H. & M. Sand & Gravel Co., Findlay. The Northern Ohio Sugar Co., a subsidiary of The Great Western Sugar Co., produced and used quicklime for sugar refining at Findlay. Clay for manufacturing heavy clay products was produced by Hancock Brick & Tile Co., Findlay.

Hardin.—Limestone was produced by Hardin Quarry Co., Dunkirk, and Herzog Lime & Stone Co., Forest. Hardin Quarry Co. installed new equipment for producing ground limestone for agstone. Herzog Lime & Stone Co. acquired a new rotary-type drill and a new loader.

Harrison.—The county continued to be the leading coal-producing area in Ohio. Production totaled 7.8 million tons, an increase of 5 percent over that of 1961. Twenty-four mines were active compared with 22 in 1961. Most of the coal was cleaned at the Georgetown plant of Hanna Coal Co., Division of Consolidation Coal Co., and the Nelms plant of Youghiogheny & Ohio Coal Co. In addition, a substantial quantity of coal was crushed and treated for dust prevention and antifreezing. Hanna Coal Co. also quarried limestone for aggregate and agstone at Cadiz. The company installed a new crusher to increase production. The Bowerston Shale Co. mined shale for drain tile near Bowerston.

Henry.—Construction sand was produced by Turkey Foot Sand & Gravel and Napoleon Sand & Gravel Co., both near Napoleon. County output was higher than that of 1961. August Honeck & Son, Malinta, and Napoleon Brick & Tile Works, Napoleon, mined clay for manufacturing drain tile.

Highland.—Limestone was produced by Highland Stone Division, Davon Inc., and Marshall Quarry, both near Hillsboro, and Ohio

Asphaltic Limestone Co., Inc., New Vienna. Output was used exclusively for aggregate and agstone. Construction sand and gravel was produced near Greenfield and Hillsboro. Clay was mined by The Mowrystown Brick & Tile Co., Mowrystown, for manufacturing building brick and drain tile.

Hocking.—Although the number of active mines decreased from 9 to 7, coal production increased 25 percent over that of 1961 and totaled 68,000 tons. General Hocking Brick Co. mined clay and shale from pits near Logan. Output was used for manufacturing building brick. Crews of the Hocking County Highway Department produced limited quantities of bank-run fill gravel.

Holmes.—Coal production increased from 172,000 tons in 1961 to 243,000 tons. Five mines (four strip and one underground) were active compared with seven mines in 1961. Briar Hill Stone Co. produced sandstone for architectural use at two localities. Variegated Quarries Division, The Nicholl Stone Co., produced sandstone blocks at its Richland township quarry and operated a plant at which it sawed the material as well as sandstone blocks produced in Coshocton County. Plastic fire clay and limestone was produced at Berlin by Holmes Clay Division of Holmes Limestone Co. Clay also was minded by Belden Brick Co. and Massillon Refractories Co., both near Berlin, and General Clay Products Co. near Baltic. Building and paving sand and gravel was produced by Feikert Sand & Gravel, Close Sand & Gravel Co., both near Millersburg, and Gallo & Son's Inc., Holmesville.

Huron.—Structural and paving gravel was produced by Huron Sand & Gravel, Inc., New London. Humus peat was produced near Willard by Mel-lo Peat Co.

Jackson.—Output of coal totaled 301,000 tons, 1 percent higher than that of 1961. The number of active mines increased from 15 in 1961 to 17. Coal was cleaned by wet washing at Waterloo by Waterloo Coal Co., Inc. Fire clay for refractories was produced at four operations near Oak Hill. Limestone for concrete aggregate also was produced at Oak Hill.

Jefferson.—The county continued to rank third in coal production. Output totaled 3.3 million tons, an increase of 4 percent over that of 1961. The number of active mines increased from 51 in 1961 to 56. Coal cleaning plants were operated by North American Coal Corp. and Hanna Coal Co., Division of Consolidation Coal Co. Coal was crushed at seven plants and output totaled 1.4 million tons. Clay was mined from pits near Irondale, Toronto, and Empire. Output was above that of 1961. The Hammondsville sandstone quarry of Freeport Quarries, Inc., discontinued operations.

Knox.—Sand and gravel output totaled 863,000 tons, 11 percent more than in 1961. Production was reported from operations near Brinkhaven, Gambier, Fredericktown, and Mt. Vernon. Molding and glass sand and ground sand were produced by The Millwood Sand Co. at Howard. Briar Hill Stone Co. operated two sandstone quarries for the production of architectural stone.

Lake.—Rock salt was produced by Morton Salt Co. at its Fairport underground mine near Painesville. The company improved operating facilities by installing crushing and screening equipment underground. In addition, underground storage of fine material was

provided. Diamond Alkali Co. produced quicklime at Painesville and salt brine from nearby wells. The brine and quicklime were used for manufacturing chlorine and alkalies. Quicklime also was produced by Grand River Lime Co., Grand River. The company utilized limestone quarried in Michigan and transported to the plant by boat. Most of the quicklime was sold for metallurgical uses. Portland and masonry cements were produced at Painesville by Standard Portland Cement Division, Diamond Alkali Co. Clay mined nearby and purchased limestone and gypsum were the principal raw materials for cement. The company acquired a new diesel shovel for its clay pit operations. Shipments of finished portland and masonry cements were principally to Ohio and western Pennsylvania. Commercial output of sand and gravel totaled 220,000 tons compared with 299,000 tons in 1961. Principal producers were Sperry Road Sand & Gravel Co., Willoughby; Erie Road Sand & Gravel, Painesville; and Granger Sand Co., Mentor.

Lawrence.—Marquette Cement Manufacturing Co., Superior, and Alpha Portland Cement Co., Ironton, produced portland and masonry cements. Marquette mined limestone and shale and Alpha mined limestone and sandstone for use as cement raw materials. In addition, gypsum and iron materials were used by both companies as cement raw materials. Finished portland cement shipments were made principally to consumers in Ohio, West Virginia, and Kentucky. Limestone also was quarried by W. E. Engle Co., Pedro, for concrete aggregate and riprap. Lawrence County Highway Department quarried limestone for road construction and repair. Clay, mostly fire clay, was recovered from operations near Ironton, Blackford, Portsmouth, and Pedro. Construction sand and gravel was produced by Wilson Sand & Gravel Co., Chesapeake. Lawrence Refractories Co. produced industrial sand at Pedro. Coal production continued to decline and totaled 383,000 tons. All production was from five strip mines. Collins Mining Co. operated a cleaning plant using jig equipment.

Licking.—Production of commercial sand and gravel totaled 746,000 tons, 12 percent more than in 1961. Most of the material consisted of processed building and paving sand and gravel. Principal producers were American Aggregates Corp., Dry Creek Crushed Gravel Co., and Alexandria Sand & Gravel Co., all near Newark. Significant tonnages also were reported from operations near Granville. A limited quantity was produced by Government-and-contractor operations. Specimens of jasper agate were recovered near Pleasant Valley.

Logan.—Output of limestone increased slightly and totaled 236,000 tons. Producers were C. E. Duff & Sons, Inc., Huntsville; Northwood Stone & Asphalt Co., Belle Center; and Connolly Construction Co., East Liberty. Production of sand and gravel totaled 94,000 tons, a decrease compared with that of 1961. Production was reported from operations near Bellefontaine, Huntsville, Quincy, and Zanesfield. No peat production was reported.

Lorain.—Dimension sandstone used primarily in architectural applications was produced by Cleveland Quarries Co., Amherst, and The Nicholl Stone Co., Kipton. Cleveland Quarries also fabricated stone for lining steel furnaces. Nicholl Stone Co. also produced grindstones. Production of sand and gravel increased and was reported

by four operations, three near Lorain and one near Elyria. Calcined gypsum was produced at the Lorain plant of National Gypsum Co.

Lucas.—Medusa Portland Cement Co. mined limestone, sand, clay, and shale for use in manufacturing cement at its plant near Toledo. Types I–II (general use) portland cement were manufactured and shipped to consumers in Ohio, Michigan, Indiana, and Illinois. Limestone for aggregate was produced by The France Stone Co., Waterville; Maumee Stone Co., Maumee; and Toledo Sand & Glass Sand Co., Sylvania. The Toledo House of Correction near Whitehouse produced rough blocks and rubble from its limestone quarry. Production of construction sand and gravel was reported from four operations near Toledo and one near Holland. Output increased over that of 1961.

Madison.—Construction sand and gravel was produced by The West Jefferson Sand & Gravel Co., West Jefferson, and McMullen Sand & Gravel Co., Mt. Sterling. Limestone used mainly for aggregate was produced by Madison Stone Co., Inc., Galloway, and Connolly Construction Co., Plain City. Clay used for manufacturing drain tile was obtained from a pit near London.

Mahoning.—Output of coal totaled over 1 million tons, a slight increase over that of 1961. Nineteen strip mines were active, one less than in 1961. Reed-sedge peat was produced near Damascus by Beaver Peat Products Co. Carbon Limestone Co. produced stone for flux, aggregate, and agstone near Lowellville. Limestone for aggregate was produced by Alliance Stone Co. near Alliance. The company installed an additional crusher. Miscellaneous clay was obtained from pits near Alliance and Beloit, and fire clay near Canfield and Petersburg. Gurlea Sand & Gravel, Salem, produced construction sand and gravel. Lowellville Sand & Gravel Inc., Lowellville, discontinued operations.

Marion.—National Lime & Stone Co., J. M. Hamilton & Sons Co., both near Marion, and Tri County Limestone Co., LaRue, produced limestone primarily for aggregate and agstone. Marion Brick Corp. produced clay near Iberia. Output of sand and gravel increased and was reported principally from operations near Prospect.

Medina.—Sand and gravel production totaled 493,000 tons compared with 542,000 tons in 1961. Output came principally from three operations near Lodi, and one each near Seville and Wadsworth. Clay for manufacturing building brick was produced by Wadsworth Brick & Tile Co., Wadsworth.

Meigs.—Commercial sand and gravel output decreased compared with that of 1961. Principal producers were Richards & Sons Inc., Tri-State Materials Corp., both near Apple Grove, and Goeglein Gravel Co., Middleport. Evaporated salt was produced in open pans at the Pomeroy operation of Excelsior Salt Works, Inc. Coal production increased 11 percent over that of 1961 and totaled 258,000 tons. Nineteen mines were active, two more than in 1961.

Mercer.—The John W. Karch Stone Co., Celina, and Rockford Stone Co., Rockford, produced limestone used mainly for aggregate and agstone. Commercial sand and gravel production was reported.

Miami.—Armco Steel Corp. produced limestone for metallurgical flux, aggregate, and agstone at Piqua. Sand and gravel production totaled 468,000 tons, about the same as in 1961. Principal producers

were Steiner's Sand & Gravel Co., Ludlow Falls, and Troy Gravel Co., Troy. Other areas of production included Bradford, Covington, Piqua, and Vandalia. No peat production was reported.

Monroe.—Blaney Sand & Gravel, Inc., Clarington, produced processed building and paving sand and gravel. Bank run gravel was produced at the Witten Gravel pit near Woodsfield by Watson Piatt.

Montgomery.—The county continued to rank third among the sand and gravel producing counties. Commercial production totaled 2.4 million tons, 16 percent below that of 1961. Output by Government-and-contractor operations dropped sharply and totaled 4,000 tons. Commercial output was reported from 21 principal operations. Leading producers included American Aggregates Corp., two plants near Dayton; Hilltop Concrete Corp., West Carrollton; Miller Bros., Tipp City; Moraine Materials Co., Dayton; and Wysong Gravel Co., with plants near Germantown and Dayton.

Limestone for aggregate was produced by Limestone-Dayton Co., Division of American Aggregates Corp., and Carey Brothers Stone Co., both near Dayton. American Aggregates Corp. also produced limestone for aggregate and agstone at Phillipsburg. Quicklime was produced in a rotary kiln from calcium carbonate sludge recovered from the softening of water by the City of Dayton Water Department. Most of the material was used by the Department for water purification and softening, but surplus quicklime was sold to other municipalities for water treatment.

Morgan.—Output of coal totaled 2.2 million tons, a slight decrease from that of 1961. All production was from four strip mines. Central Ohio Coal Co. produced most of the output from its Muskingum mine and cleaned the coal at its preparation plant. County output of sand and gravel was principally by Stockport Sand & Gravel Co., Stockport. D. & K. Construction Inc. (formerly J. L. Prewett), Reinersville, produced limestone for riprap.

Morrow.—Chesterville Sand & Gravel Co. produced construction sand and gravel at Chesterville.

Muskingum.—Columbia Cement Corp. used limestone mined underground and shale recovered from an open pit for manufacturing portland and masonry cements at its East Fultonham plant. Most of the finished portland cement was shipped to consumers in Ohio and West Virginia. Limestone for aggregate was produced by Chesterhill Stone Co., East Fultonham; Sidwell Brothers, Zanesville; and D. & K. Construction Inc., Cumberland. Chesterhill Stone improved plant facilities by adding a screen house, bins, and a fourth crusher. Sand and gravel was produced by Zanesville Gravel Co., Dresden; Muskingum River Gravel Co., Zanesville; and Donald E. Minnich, Trinway. The Bowerston Shale Co., Frazeysburg, mined shale for manufacturing building brick. Ivan L. Hammer, East Fultonham, produced stoneware clay. Mineral specimens were collected in the county. Coal production increased from 101,000 tons in 1961 to 274,000 tons. Seven underground and five strip mines were active.

Noble.—Output of coal increased slightly and totaled 1.4 million tons. Production from auger mines increased from 26,000 tons in 1961 to 256,000 tons. Eight strip and six auger mines were operated. Limestone for aggregate was produced by James Merry Stone Co., Caldwell; Herman Zerger, Jr., Stock Township; and Lawrence King,

Cumberland. Lawrence King moved its quarrying operations from near Caldwell to southeast of Cumberland. Ava Brick Corp., Ava., produced shale for manufacturing brick.

Ottawa.—Quicklime and hydrated lime were produced at the Genoa plant of United States Gypsum Co. from limestone quarried nearby. Some limestone was sold for aggregate. The Clay Center lime plant of Basic., Inc., remained idle, but the company operated its nearby limestone quarry for the production of aggregate. Chemstone Corp., Division of Minerals & Chemicals Philipp Corp., operated its Marblehead limestone quarry until the end of November. The quarry operation was taken over at that time by The Standard Slag Co. of Youngstown. Output from the quarry was sold as aggregate, agstone, flux, and sinter stone. Crude gypsum was mined by Celotex Corp., Port Clinton, and United States Gypsum Co., Gypsum. Output was calcined at nearby plants for use in manufacturing finished gypsum building products. Fluorite and celestite specimens were collected near Clay Center.

Paulding.—Peninsular Portland Cement Div., General Portland Cement Co., mined limestone and shale near Paulding and purchased sand and gypsum for manufacturing portland cement at its nearby plant. Peninsular used the wet process to produce general use and high-early-strength portland cement and masonry cements. Some finished cement was transferred to the company's Cement City, Mich., plant; the remainder was sold to customers in Ohio, Indiana, and Michigan. Limestone from the Peninsular quarry was shipped to the Michigan plant for processing and some was sold to The France Co. for processing and sale as aggregate, agstone, railroad ballast, and riprap. Other limestone quarries were operated by Auglaize Stone Co., Oakwood, and Junction Quarry Inc., Junction. Haviland Clay Works Co., Haviland, and Baughman Tile Co. and Dangler Drain Tile Co., both near Paulding, mined clay for drain tile.

Perry.—Coal production increased; 21 mines were active compared with 18 in 1961. Peabody Coal Co. and Sidwell Bros. Coal Co. operated wet-washing coal cleaning and preparation plants. Central Silica Co., Glenford, and Keener Sand & Clay Co., New Lexington, produced industrial sands. Clay, mostly as miscellaneous clay and shale, was produced at eight operations, compared with nine in 1961. Output was centered near Gore, Junction City, Logan, New Lexington, Saltillo, Somerset, and Shawnee. Maxville Stone Co., Logan, and Morris Bros. Lime & Stone (formerly Beiter Stone Co.), Rushville, produced limestone for aggregate and agstone. During 1962, Morris Bros. reconditioned most of its plant equipment.

Pickaway.—Processed construction sand and gravel was produced by The Sturm & Dillard Co., Circleville. Bank-run material also was produced by McFarland Co. at Circleville.

Pike.—Construction sand and gravel was mined from pits near Sargents, Lucasville, and Waverly. Industrial sand and gravel was produced at Jackson. Ralph Rogers & Co. of Ohio, Inc., Latham, quarried limestone for aggregate and agstone. The company abandoned quarry operations when its lease expired in October.

Portage.—Sand and gravel output totaled 1.9 million tons, 8 percent more than in 1961. Production was reported from 23 operations near Ravenna, Kent, and Mantua. Industrial sands were produced by

Industrial Silica Division, Pennsylvania Glass Sand Corp., at the Geauga works near Aurora and the Portage works near Garrettsville. Other leading producers included The Standard Slag Co., Mantua, and Hilltop Sand & Gravel Co. and Stroup & Sons Sand & Gravel Inc., both near Mogadore. Quartzite for silica brick was produced by Harbison-Walker Refractories Co. and General Refractories Co. Shale used for manufacturing vitrified sewer pipe was mined near Diamond by United States Concrete Pipe Co. Peterson Coal Co. strip mine continued as the only coal producer. Output was processed at the company's Atwater cleaning plant. Green Oaks Peat Moss Co. and Portage Peat recovered peat from bogs near Ravenna.

Preble.—Limestone was mined by Marble Cliff Quarries Co. to supply its Lewisburg lime plant and for sale as aggregate, agstone, and flux. Both quicklime and hydrated lime were produced for chemical and other industrial uses. White Gravel Co., Camden; Steiner's Sand & Gravel Co. and Blue Bank Gravel Co., both near West Alexandria, produced construction sand and gravel.

Putnam.—Limestone for aggregate was quarried by National Lime & Stone Co., Columbus Grove; The Putnam Stone Co., Ottawa; and Ottawa Stone Co., Inc., Gilboa. Buckeye Sugars Inc., Ottawa, produced and used quicklime for sugar refining. The company burned limestone shipped from Michigan. Ottawa Stone improved its plant by adding a screen and a secondary crusher to its processing facilities. Glandorf Tile Co., Glandorf; Etter Tile & Coal Co., Dupont; Miller Bros. Clay Works, Inc., Ottoville; and Leipsic Clay Products Co., Leipsic, mined clay for drain tile.

Richland.—Commercial output of sand and gravel totaled 336,000 tons compared with 442,000 tons in 1961. Production was reported from operations near Bellville, Lexington, and Perryville. Shale for manufacturing brick was produced by Richland Shale Brick Co. and Ohio Brick & Supply Co., both near Mansfield. Reynolds Farms, Inc., produced moss peat near Ganges.

Ross.—Sand and gravel output increased and consisted chiefly of processed material for construction. Principal producers were Central States Construction Co. and Brewer & Brewer Sons Inc., both near Chillicothe, and Miami Gravel Co., Richmond Dale. Southern Silica, Inc., Richmond Dale, quarried sandstone for foundry use and glass manufacture. The company acquired additional haulage equipment during 1962. Limestone production stopped at the Bainbridge operation of Paint Valley Sand & Gravel Co., the business was discontinued in August. Chillicothe Division, The Mead Corp., produced and used regenerated quicklime for manufacturing paper at Chillicothe.

Sandusky.—Although totals were lower than in 1961, the county continued to lead in production and value of limestone and lime. Output of lime, including dead-burned dolomite, decreased 1 percent and totaled 883,000 tons valued at $14.4 million. Most of the output was dead-burned dolomite used as refractory material by the steel industry. Eight plants were active compared with nine in 1961. The Woodville lime plant of Woodville Lime & Chemical Co. was idle, but the quarry was operated to produce limestone for flux, aggregate, and agstone. Gibsonburg Lime Products Co. purchased the Gibsonburg lime plant and quarry of Basic Inc. in January.

Gibsonburg operated both lime plants the rest of 1962. Limestone for both plants was obtained from the Gibsonburg quarry. Limestone also was quarried at other operations near Gibsonburg, Woodville, Bellevue, Fremont, and Millersville. Production totaled 2.7 million tons, 15 percent below that of 1961. The limestone was used for manufacturing lime (53 percent), aggregate (19 percent), metallurgical flux (15 percent), and other uses including agstone. The J. E. Baker Co. added conveyors and storage bins to its Millersville operation. Home Sand & Coal Co., Fremont, recovered structural sand by dredging.

Scioto.—Sandstone was quarried and sawed for furnace brick and architectural purposes by Waller Bros. Stone Co. and The Taylor Stone, both of McDermott. General Refractories Co. produced quartzite for silica brick at its Thompson mine. Fire clay was produced principally near Portsmouth and South Webster. Lucasville Sand & Gravel, Lucasville, produced bank run sand and gravel.

Seneca.—Basic, Inc., produced dead-burned dolomite from dolomite mined nearby in nine coal-fired rotary kilns at its Maple Grove plant. The stone also was sold for aggregate, metallurgical flux, and agstone. Limestone was quarried by The France Stone Co. and Webster Stone Co., both near Bloomville, and Northern Ohio Stone Co., Flat Rock. Webster Stone Co. changed from shovel to dragline at its Bloomville quarry. J. A. Miller Tile Co., Bascom, and St. Stephen Tile Co., Attica, produced clay for drain tile.

Shelby.—Construction sand and gravel was produced by Sidney Sand & Gravel Co., Sidney; The Ernst Gravel Co., Houston; and Spring Creek Gravel Co., Fort Laramie. Miami River Quarries Inc., Sidney, produced limestone for construction.

Stark.—Portland and masonry cements were produced at the Middle Branch plant of Diamond Portland Cement Co., Division of The Flintkote Co., from limestone and shale mined nearby. Most of the finished cement was shipped to consumers in Ohio, and some was shipped to Pennsylvania, West Virginia, and New York. Output of sand and gravel totaled nearly 2 million tons, 18 percent higher than in 1961. Production was reported principally from operations near Canton, Massillon, and Navarre. Major producers were The Standard Slag Co., Massillon, and Canton Aggregate Co. with four plants near Canton. Industrial sand was produced at Canal Fulton by Tuscora Foundry Sand Co. East Ohio Limestone Co., Hartville; ELMCO Limestone & Coal Co., Canton; and Alborn Coal & Lime Co., East Sparta, produced limestone for construction. Stark County continued to be one of the leading clay-producing counties. Most of the output was fire clay for refractories and heavy clay products. Clay was recovered from 20 operations compared with 19 in 1961.

Coal production totaled 658,000 tons, 14 percent below that of 1961. All production was from 19 strip mines, compared with 15 in 1961. Peat was produced by Gerald R. Hetrick, Lab Nursery & Peat Moss, Lantz Peat Moss, Inc., and Sanders Peat Moss Co., all near Kent.

Summit.—Pittsburgh Plate Glass Co., Chemical Division, produced salt brine, quicklime, limestone, portland cement, and sandstone at Barberton. Salt brine pumped from nearby wells produced evaporated salt and combined with quicklime produced chlorine and alkalies. Raw material for the lime plant (six coal- and coke-fired shaft

kilns) and the single rotary cement kiln was supplied from the company's nearby underground limestone mine. Some limestone was produced for aggregate. Finished portland cement shipments were primarily to Ohio consumers, and some went to western Pennsylvania and West Virginia. Output from the company's sandstone quarry was used in glass manufacture and as concrete aggregate. Diamond Crystal Salt Co., Akron, produced salt brine from nearby wells. Most of the brine was used for manufacturing evaporated salt in both open and vacuum pans; and some of it was marketed as pressed blocks. Brine also was sold to the rubber industry. Evaporated salt was sold for a variety of uses. Sand and gravel production totaled 994,000 tons compared with 834,000 tons in 1961. Output was reported from 14 operations, most of them near Akron and Barberton. Camp Brick Co. produced shale at Mogadore. Robinson Clay Products Co., Mogadore, mined plastic fire clay and miscellaneous clay.

Trumbull.—Sand and gravel output consisted chiefly of material processed by The Kinsman Sand & Gravel Co., Kinsman.

Tuscarawas.—Coal production increased 7 percent over that of 1961 and totaled 2.4 million tons. Fifty mines (31 strip, 12 underground, and 7 auger) were active, compared with 48 mines in 1961. Pittsburgh Plate Glass Co. cleaned coal at its Midvale mine. Although output decreased 10 percent from that of 1961, Tuscarawas continued as the leading clay-producing county. Production was reported from 24 active mines compared with 28 in 1961. Seventy-seven percent of the total output was fire clay used for refractories and heavy clay products. Miscellaneous clay was used for manufacturing heavy clay products and floor and wall tile. Sand and gravel production decreased, and output was reported from nine operations compared with eight in 1961. Industrial Silica Division, Pennsylvania Glass Sand Corp., produced industrial sands at the Coxey Works near Dundee. Leading producers of construction material were Edgar Spring, Inc., Sandyville, and Spring Brothers, New Philadelphia. Limestone was quarried by Kimble Limestone Co., Dover, and Bonum Lime Co., Sugar Creek. The limestone quarry of Limestone Aggregates, Inc., was idle. Yoder Stone co. quarried sandstone for architectural work at Dundee.

Union.—Union Limestone, Inc., Ostrander, and L. G. Rockhold & Sons, York Center, produced limestone for construction and agstone. Commercial sand and gravel was produced principally by Marysville Concrete & Materials, Inc., Marysville. Output consisted chiefly of processed construction material.

Van Wert.—The Union Quarries Co. and Ridge Township Stone Quarry, both near Van Wert, and Delphos Quarries Co., Delphos, produced limestone for construction and agstone. Delphos Quarry acquired new equipment including a portable conveyor and an electrically heated screen. Delphos Clay Works Co., Delphos, and Weck Tile Plant, Van Wert, mined clay for manufacturing drain tile.

Vinton.—Coal production decreased from 149,500 tons in 1961 to 101,000 tons. Thirteen mines (8 underground and 5 strip) were active, compared with 12 mines in 1961. McArthur Stone & Coal Co. produced limestone for aggregate and agstone. The McArthur Brick Co., McArthur, and Hope Fire Clay Co., Zaleski, mined clay.

Warren.—Commercial output of sand and gravel totaled 750,000 tons compared with 564,000 tons in 1961. As in 1961, eight operations were active. Most of the output consisted of processed building and paving material. Production by Government-and-contractor operations decreased. Some limestone for aggregate was produced under contract for the Ohio State Highway Department.

Washington.—Coal production increased, and the number of active mines (three strip and two auger) remained the same as in 1961. Sand and gravel production also was virtually the same as in 1961. Construction material was recovered from pits at Little Hocking, Marietta, New Matamoras, and Waterford. Hall Grindstone Co. produced abrasive stone (grindstone) at its No. 4 quarry near Constitution.

Wayne.—Morton Salt Co. produced evaporated salt at Rittman by vacuum and open pans, and some was marketed as pressed blocks. Sand and gravel output increased, and most of it consisted of processed construction material. Rupp Construction Co., Inc., Marshallville, was the foremost producer. Mullet Coal Co. produced limestone (for aggregate and riprap) and plastic fire clay at Mount Eaton. Wayne County Quarries Inc., Fredericksburg, produced limestone for aggregate. Clay was produced by Medal Brick & Tile Co., Wooster, and Orrville Tile Co., Orrville. Coal production dropped from 75,000 tons in 1961 to 51,000 tons. All production was from two strip mines.

Williams.—Commercial sand and gravel production decreased slightly compared with 1961. Most of the material was processed construction sand and gravel. Principal producers were Tri-State Gravel Co., Montpelier; Wortkoetter Gravel Co., Blakeslee; Mason Sand & Gravel Co., Edon; and Hoffman Sand & Gravel, Edgerton. Stryker Drain Tile Co., Stryker, mined clay for drain tile.

Wood.—Limestone production totaled 571,000 tons, 9 percent less than in 1961. Production was reported from seven operations, two near North Baltimore and one each near Custar, Luckey, Perrysburg, Portage, and West Millgrove. Maumee Stone Co. acquired the Portage plant of Wood County Stone & Construction Co. Brough Stone Co., West Millgrove, improved the screening operation at its plant. No clay production was reported as the Perrysburg plants of Rossford Brick & Tile Co. and Perrysburg Tile & Brick Co. were both idle. Clay production was expected to be resumed in 1963.

Wyandot.—Limestone and lime were produced at Carey by National Lime & Stone Co. In addition to supplying the lime plant, limestone was sold for aggregate, metallurgical flux, railroad ballast, agstone, glass manufacture, fertilizer filler, and for laying dust in coal mines. At the Carey plant, output consisted chiefly of quicklime for the glass industry. Quicklime was shipped principally to consumers in Indiana, Pennsylvania, and Illinois. Limestone also was produced by Wyandot Dolomite, Inc., Carey; and Kuenzli Quarries Co., Inc., and J. L. Foucht Quarry, both near Upper Sandusky. Wyandot Dolomite, Inc., improved its plant by adding electrical heat to its screening operation. Sand and gravel was produced by Wilson Sand Co., Corfman Gravel Co., and Kuenzli Quarries Co., Inc., all near Upper Sandusky. The Claycraft Co., Upper Sandusky, mined shale for manufacturing building brick. The company increased its plant capacity by modernization. The Humus Co. mined humus peat at Carey for sale in packages and bulk.

The Mineral Industry of Oklahoma

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior and the Oklahoma Geological Survey for collecting information on all minerals except fuels.

By Robert B. McDougal [1] and William E. Ham [2]

VALUE of mineral production in Oklahoma increased to a record $843 million, which was $51.5 million more than that of 1961 and $33 million more than the previous high set in 1957. The increase resulted from improved production of petroleum, natural gas, and coal in the fuels segment of the mineral industry and greater output of cement, stone, gypsum, zinc, lead, lime, tripoli, and salt in the minerals portion of the industry. Mineral fuels, accounting for 94 percent of the total mineral value, dominated the State mineral industry. Lead and zinc production rose significantly as funds were made available to subsidize small operators under the lead-zinc stabilization program.

Seventeen minerals—5 mineral fuels and 12 minerals—were produced in 74 of 77 counties. Natural gas and petroleum were produced in 68 counties from nearly 2,400 pools, distributed primarily in a wide belt extending from the northeastern to the southwestern and western sections of the State. Helium was recovered in Cimarron County. Nonmetals were produced in a large area covering 58 counties, primarily in the northeast, north-central, and central areas, and in the Arbuckle and Wichita Mountain regions of the southern area. Metal production was confined to Ottawa County.

Employment and Injuries.—*Employment and Wages.*—Mineral industries in Oklahoma employed 43,800 persons, a 3-percent decline from 1961, as employment in oil and gas drilling and production and coal mining continued to drop. As defined by the Oklahoma Employment Security Act, which covers establishments that employ four or more persons, the mineral industries paid $266 million in wages to 42,300 persons.

Injuries and Fatalities.—Eight fatalities occurred in the fuels segment of the mineral industries, seven at oil and gas well drilling sites and one as a result of injuries sustained in a coal mine. Two persons were killed and one injured in the metal mining portion of the mineral industries when a pillar and adjoining roof collapsed in a lead-zinc mine.

Labor Disputes.—Window-glass production halted for 8 days beginning May 10 when nearly 400 production workers and glass cutters refused to cross picket lines established by the clerical workers at the

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TABLE 1.—Mineral production in Oklahoma [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays [2] thousand short tons	792	$801	737	$756
Coal (bituminous) do	1,032	6,784	1,048	6,978
Gypsum do	(3)	(3)	509	1,668
Helium thousand cubic feet	313,244	5,872	284,214	9,917
Lead (recoverable content of ores, etc.) short tons	980	202	2,710	499
Natural gas million cubic feet	892,697	108,016	1,060,717	135,772
Natural gas liquids:				
Natural gasoline and cycle products thousand gallons	521,237	33,358	552,795	35,764
LP gases do	817,082	30,141	838,903	25,223
Petroleum (crude) thousand 42-gallon barrels	193,081	561,866	[4] 198,616	[4] 579,959
Salt thousand short tons	3	19	5	25
Sand and gravel do	5,310	5,513	4,436	4,736
Stone do	14,981	16,561	14,666	18,819
Zinc (recoverable content of ores, etc.) short tons	3,148	724	10,013	2,303
Value of items that cannot be disclosed: Bentonite, cement, gem stones, lime, pumice, tripoli and value indicated by footnote 3		21,920		20,853
Total		[5] 791,777		843,272

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producer).
[2] Excludes bentonite; included with "Value of items that cannot be disclosed."
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Preliminary figure.
[5] Revised figure.

TABLE 2.—Annual average employment in the mineral industries

(Thousands)

Industry	1953-57 (average)	1958	1959	1960	1961	1962 [1]
Oil and gas drilling and production	47.56	45.8	45.0	42.6	42.5	41.4
Coal mining	1.26	.9	.9	.7	.6	.5
Other mining	2.16	1.8	1.8	1.8	1.9	1.9
Total	50.98	48.5	47.7	45.1	45.0	43.8

[1] Preliminary figures.

Source: Oklahoma Employment Security Commission, Handbook of Oklahoma Employment Statistics, 1939-62.

Okmulgee plant of the American-St. Gobain Corp.; the issue was equalization of pay rates at the plant with those at the firm's plants in Jeannette and Arnold, Pa. Work halted for 5 days in May at the Standard Magnesium Corp. plant in Tulsa because of a wage dispute. Employees struck again in July, but supervisory personnel maintained production. The National Zinc Co. smelter at Bartlesville shut down from June 1 to August 2 when 465 members of the Oil, Chemical, and Atomic Workers were on strike after contract negotiations failed in a dispute over wages, manpower utilization, and fringe benefits.

Consumption and Markets.—A major portion of the State mineral output was processed into semifinished and finished products for intrastate use and interstate shipment. Industries involved were oil refineries; gasoline and cycle plants, which stripped condensable liquids from natural gas; a helium extraction plant; zinc smelters, which reduced zinc ore concentrate; cement, brick, tile, pottery, and glass plants, which used limestone, gypsum, clays, shales, and silica sands mined in

Oklahoma; building products manufactured from gypsum mined in the State; and one producer of lime and calcium carbide manufactured from locally mined limestone. Large quantities of natural gasoline and petroleum products were transported by pipelines to industrial areas of the Eastern and North-Central States. Ammonia was produced from natural gas and carbon black from petroleum distillates.

Demand for Oklahoma crude petroleum increased for the second consecutive year and at yearend was almost 5 million barrels greater than in 1961. Under State regulatory control, output was maintained in close balance with demand and stocks.

Mining activity in the Tri-State District was considerably greater than in 1961. Funds became available early in 1962 to administer the lead-zinc stabilization program (Public Law 87–347), and authority to purchase under the program was delegated by the Office of Minerals Exploration, Department of the Interior, to the General Services Administration.

Total construction (residential, nonresidential, and public works) exceeded the record established in 1961. Rising income and industrial expansion resulted in a phenomenal growth in construction, the value of which reached $1.3 billion, a 24-percent increase over 1961. Residential construction was the primary factor as more people with rising incomes moved to urban areas and built or enlarged dwellings. The trend toward apartment houses also helped the residential building upsurge, which was 30 percent greater than in 1961. In the other construction categories, commercial building was 14 percent above 1961 and was exceeded only by 1958. Industrial building gained by 27 percent. However, 1961 was an unusually low year and 1962 could not be considered an exceptionally good year for factory construction. Public works, construction recovering from a slack year, was 5 percent above that of 1961. Public utilities construction was down 8 percent, continuing a pattern that began in 1956.

Trends and Developments.—Natural gas reserves increased slightly, but recoverable petroleum reserves declined. Although slightly improved over 1961, exploratory well drilling was not particularly successful, because only 132 of 433 wells drilled proved productive. Kingfisher and Garfield Counties had 13 discoveries each; McClain County 6; Cleveland and Woodward Counties 5 each; and Grant, Logan, Texas, and Woods Counties 4 each. The huge Anadarko basin in western and northwestern Oklahoma completed another successful year because oil and gas were found in 60 of 133 exploratory wells. Exploration in southern and southwestern Garfield County was equally successful as 12 new oil and gas fields were opened. In southeastern Oklahoma and western Arkansas, the Arkoma basin still held promise of additional gas reserves. Several pipeline companies proposed or were seeking authority to build pipelines into the basin which lacked access to markets.

Continental Oil Co. dedicated its new $2.2 million research and development center at Ponca City. Completion of the facilities doubled the size of the research center. In July, the company completed a building at Ponca City to house its cenetral computer department and process center. A service organization, the process center does plant design and economic work for the company's manufacturing, petrochemical, and international departments. Kerr-McGee Oil In-

dustries, Inc., announced plans to build a million-dollar research center at Oklahoma City to centralize its research activities. Sinclair Research, Inc., began constructing a $4 million exploration and research center at Tulsa with completion scheduled for early 1963; the new facilities would permit expansion of the company's research activities.

Callery Chemical Co. stopped producing high-energy boron hydride fuels in January and placed its Muskogee plant on standby status for the rest of 1962.

John Deere Chemical Co. announced plans to boost ammonia output at Pryor with a $3.1 million expansion program. Natural gas was to be used to produce high-purity anhydrous ammonia for use in manufacturing of synthetic fertilizers and feed supplements. A $400,000 expansion project was announced for the company's Tulsa plant. New air-pollution control equipment was installed to eliminate noxious fumes. Equipment to eliminate dust and odor was to be installed later.

Oklahoma Cement Co. completed a $5 million expansion project which doubled production capacity to 2 million barrels annually at its Pryor plant. Dewey Portland Cement Co., a division of Martin Marietta Corp., resumed full production at its Dewey plant early in January. The plant had been closed since October 1961. However, in April the company announced a partial cutback in operations and dismissal of some 100 employees at Dewey. Shipments of finished cement from stocks would continue.

Southwestern Gypsum Co., near Weatherford, began producing gypsum for agricultural purposes.

Ball Brothers Co., a glass container manufacturing concern, began a $1.5 million expansion at its Okmulgee glass plant in January. The program included a new warehouse and general plant modernization that involved rebuilding the furnace. Also at Okmulgee, Southwestern Sheet Glass Co. closed its glass plant after 43 years of continuous operation. The plant was one of three companies in the United States that specialized in "welded" polished wire glass.

The Sand Springs works of Sheffield Division, Armco Steel Corp., closed in mid-July for about 3 months to modernize the rolling mill production facilities. Two rolling mill production units and an automatic cooling bed replaced old hand-operated equipment. The plant specialty was concrete reinforcing bars for the construction industry.

Blackwell Zinc Co. Division of American Metal Climax, Inc., curtailed production by closing 4 of 12 furnace blocks, because increased competition for imported zinc concentrates reduced their supply of raw material. Two furnace blocks were started in the fall, but in December the company announced a reduction in smelter operations to become effective about mid-January 1963.

Standard Industries, Inc., Tulsa, purchased five quarries and a small concrete mixing plant from Cookson Quarry Co. and Burbank Stone Co., Ponca City.

Chandler Materials, Co., Tulsa, purchased the Haydite lightweight aggregate plant at Choctaw from Texas Industries, Inc., Dallas.

The U.S. Army Corps of Engineers, Tulsa District, was working on three large reservoir projects—the Eufaula Dam on the South Canadian River between Haskell and McIntosh Counties, the Oologah

Dam on the Verdigris River in Rogers County, and the Keystone Dam on the Arkansas River in Tulsa County. Construction of the Oologah Dam was virtually finished by yearend.

The Grand River Dam Authority (GRDA) began constructing the Markham Ferry Dam project on the Grand River, 12 miles southeast of Pryor, in Mayes County. The dam was renamed "Robert S. Kerr Dam" at ground-breaking ceremonies on January 1, but the "Markham Ferry" name was retained for the overall project.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Oklahoma continued to be an important source of natural gas and crude petroleum and furnished a major supply of refined products. Low-ash bituminous coal output increased slightly.

Carbon Black.—Output of carbon black increased 9 percent in quantity and 3 percent in value and was produced from petroleum distillate by Continental Oil Co. at its Ponca City refinery.

Coal (Bituminous).—An increase of 2 percent in coal production halted a decline in output that began 5 years ago. One million tons valued at almost $7 million was produced by 16 operators at 18 mines (6 underground and 12 strip) in 10 counties. Haskell, Pittsburg, Rogers, and Craig Counties led in value of output. Fifteen other producers, who mined less than 1,000 tons each, were active in Craig, Haskell, Latimer, Le Flore, Muskogee, and Pittsburg Counties.

Lone Star Steel Co. installed a new type of mining equipment—developed and used successfully in British coal mines—in its Carbon No. 5 mine near Hartshorne. The cutter moved along a 570-foot face by means of a spool within the machine, which wound up a steel rope stretched the length of the longwall. When the machine reached the end of the face, it was returned to begin again because cutting was done only in one direction. As the cutter advanced along the wall in each run, roof-supporting jacks were moved up hydraulically to protect the operation. Two 15-foot entries on either side of the face enabled the machine to cut in from the side. A 40-inch-diameter cylinder with tungsten carbide-tipped teeth could cut into the 36-inch coal seam 27 inches deep. The loose coal was placed on a moving chain conveyor by a plowlike attachment. The coal was taken from the chain conveyor to a belt conveyor which in turn carried the coal to cars.

TABLE 3.—Coal (bituminous) production

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	2,090	$12,733	1960	1,342	$9,113
1958	1,629	10,858	1961	1,032	6,784
1959	1,525	10,272	1962	1,048	6,978

In long water-filled tanks on the surface, different specific gravities enabled separation of the coal from the waste rock included in the cutting. The roof was to be allowed to collapse behind the cutting area as operations advanced, thus burying potentially explosive coal

dust and leaving less overburden weight in the mine roof. Three entries that ran perpendicular to the cutting face at each end of it provided access for men, conveyor belts, and tracks for supplies and ventilation.

Helium.—The Keyes plant of the Bureau of Mines extracted 292 million cubic feet of helium from natural gas, a 7-percent decrease from 1961. Sales to Government and commercial purchasers totaled 284 million cubic feet valued at $9.9 million, an increase of 69 percent caused entirely by the price increase on November 18, 1961. Federal agencies, such as the Atomic Energy Commission and the Department of Defense, remained the principal purchasers and accounted for more than 78 percent of the demand; civilian purchasers comprised the remainder. Helium was used in research and in missile and space vehicle programs.

A 425-mile helium pipeline from Bushton, Kans., to the Government Cliffside gasfield near Amarillo, Tex., was finished in mid-October.

Natural Gas.—Oklahoma remained the third largest gas producing State, with 64 counties, led by Texas, Beaver, Harper, Stephens, and Garvin Counties, in descending order, reporting natural gas output. Roger Mills County became the 65th county in which gas was found; however, the well was shut in pending further development of the area. Gulf Oil Corp. reentered the hole abandoned in 1953 and deepened it to 17,558 feet. Although the casing was perforated between 17,127 and 17,435 feet, the hole was plugged back to 15,148 feet and perforations were made through the casing between 14,960 and 14,980 feet in Upper Morrow sandstone. This well, which opened the West Reydon pool, was treated to flow 4 million cubic feet per day through a ½-inch choke.

TABLE 4.—Marketed production of natural gas[1]

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1953–57 (average)	645,937	$48,816	1960	824,266	$98,088
1958	696,504	70,347	1961	892,697	108,016
1959	811,508	81,151	1962	1,060,717	135,772

[1] Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.

TABLE 5.—Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

	Proved reserves, Dec. 31, 1961	Changes in proved reserves, due to extensions and new discoveries in 1962	Proved reserves, Dec. 31, 1962 (production was deducted)	Changes from 1961, percent
Crude oil—thousand barrels	1,787,429	137,084	1,728,268	−3
Natural gas liquids[1]—do	329,180	40,197	347,003	+5
Natural gas—million cubic feet	17,350,924	2,030,179	18,358,738	+6

[1] Includes condensate, natural gasoline, and LP gases.

Source: American Gas Association, American Petroleum Institute, and Canadian Petroleum Association. Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas: V. 17, Dec. 31, 1962, pp. 11, 12, 21.

Development well drilling accounted for 432 new gas discoveries and exploratory drilling for 45 gas wells. The deepest producing well in Oklahoma was the British-American Oil Producing Co. No. 1 Kreiger, completed at 16,612 feet in the Knox Bromide field, until the Mobil Oil Co. No. 1 Craddock Farm was completed to the first, second, and third Bromide lime between 16,193 to 16,669 feet in the Chitwood pool of Grady County. Later in 1962, Mobil's No. 1 Miller in the Chitwood pool tested intervals in the three Bromide limestone formations between 16,572 and 17,076 feet to become the deepest producer in the State.

Estimated natural gas reserves increased 6 percent to 18,359 billion cubic feet at yearend. Exploratory drilling added 463 billion cubic feet through new discoveries, and extensions and revisions added another 1,567 billion cubic feet to the gas reserves.

Seven gas-storage fields were in use by the natural gas industry in eight counties. A permanent gathering system and compression facilities were being installed by Oklahoma Natural Gas Co. at its new West Edmond underground reservoir in Kingfisher and Logan Counties. Underground storage facilities had a total capacity of 148.1 billion cubic feet of working gas volume (above minimum working pressure) and 101.9 billion cubic feet of cushion gas volume (below minimum working pressure). Available storage capacity permitted continuous production and conservation of casing-head gas from oil wells during periods of low demand.

Natural Gas Liquids.—Output of natural gas liquids recovered by 70 natural gasoline plants and 3 cycling plants increased to 1.4 billion gallons and represented an increase of 4 percent over 1961 output and 27 percent more than that of 1958. Natural gasoline and cycle products represented 40 percent of the quantity and 59 percent of the value in 1962; LP gases accounted for the remainder. Increased sales were directly attributable to the continuing gain in the use of LP gas for domestic heating and cooling.

TABLE 6.—Natural gas liquids production

(Thousand gallons and thousand dollars)

Year	Natural gasoline and cycle products		LP gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	473,508	$26,608	509,281	$17,588	982,789	$44,196
1958	440,798	26,029	657,114	25,822	1,097,912	51,851
1959	448,353	29,443	675,869	27,070	1,124,222	56,513
1960	531,995	33,074	762,258	32,409	1,294,253	65,483
1961	521,237	33,358	817,082	30,141	1,338,319	63,499
1962	552,795	35,764	838,903	25,223	1,391,698	60,987

New natural gas liquids recovery facilities placed on stream in Kingfisher County were the 30-million-cubic-foot-per-day Hennessey plant of Continental Oil Co.; the 77-million-cubic-foot-per-day Dover-Hennessey plant of Humble Oil & Refining Co.; the 32-million-cubic-foot-per-day North Okarche plant of Pan American Petroleum Corp.; and in Love County, the 23-million-cubic-foot-per-day Enville plant of Texaco, Inc. Cabot Corp. completed its 30-million-cubic-foot-per-

day plant in Beaver County. In addition, three gasoline plants under construction would have an estimated total processing capacity of 130 million cubic feet per day. In Carter County, Shell Oil Co. increased its Dillard plant capacity from 7 million to 15.5 million cubic feet per day. Among other changes, Keener Oil shut down and abandoned its Bartlett cycling plant near Butler, Custer County, and at yearend, Frame Natural Gasoline Co. shut down its gasoline plant near Cleveland, Pawnee County, after 50 years of continuous operation.

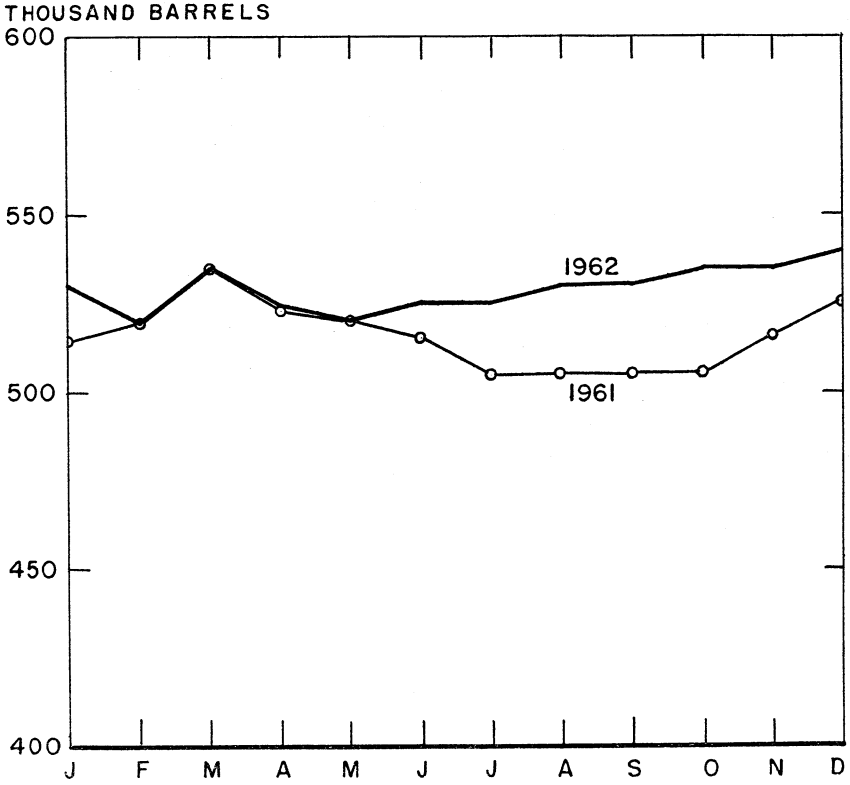

FIGURE 1.—Petroleum allowable production in thousand barrels per day established by the Oklahoma Corporation Commission, 1961–62, by months.

According to the American Gas Association, proved recoverable reserves of natural gas liquids in Oklahoma at yearend were estimated at 347 million barrels—5 percent of the U.S. total. Exploratory drilling added nearly 6 million barrels to recoverable reserves, and development drilling added 34 million barrels by extensions and revisions.

Underground storage capacity for natural gas liquids was 820,000 barrels at 7 sites, according to the Oil and Gas Journal. Completed during 1962 were the Continental Oil Co. 150,000-barrel butane storage in a salt formation in Grant County and the Warren Petroleum Corp. 35,000-barrel LP gas storage in a salt formation in Beaver County. Five other storage sites were two salt layers in Beaver and

Beckham Counties, abandoned oil wells in Pontotoc County, a depleted shale mine in Seminole County, and a limestone cavern in Kay County.

Petroleum.—Oklahoma continued to be the fourth largest crude oil-producing State. Output was nearly 3 percent greater than in 1961 and approached 200 million barrels. Petroleum output was prorated by the Oklahoma Corporation Commission under the Interstate Oil Compact to maintain a balance between production and indicated demand.

Crude oil production amounted to nearly 199 million barrels from 80,799 oil wells, compared with 1961 production of 193 million barrels from 80,814 oil wells. Daily average production of crude oil was 544,000 barrels or 6.7 barrels per well, compared with 529,000 barrels or 6.5 barrels per well in 1961. Average indicated daily demand for crude oil was 540,500 barrels, about 3 percent more than in 1961.

TABLE 7.—Crude petroleum production

(Thousand barrels and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	204,352	$575,962	1960	192,913	$553,306
1958	200,699	594,069	1961	193,081	561,866
1959	198,090	578,423	1962 [1]	198,616	579,959

[1] Preliminary figures.

TABLE 8.—Crude petroleum production, indicated demand, and stocks, in 1962, by months

(Thousand barrels)

Month	Production	Indicated demand	Stocks originating in Oklahoma	Month	Production	Indicated demand	Stocks originating in Oklahoma
January	16,992	18,624	16,168	September	16,352	16,630	16,565
February	15,708	15,155	16,721	October	16,724	15,702	17,587
March	17,492	17,362	16,851	November	16,444	14,839	19,192
April	16,995	16,849	16,997	December	16,694	16,746	19,087
May	16,232	16,073	17,156				
June	16,022	16,872	16,306	Total:			
July	16,475	17,259	15,522	1962 [1]	198,616	197,276	----------
August	16,486	15,165	16,843	1961	193,081	192,287	----------

[1] Preliminary figures.

Petroleum production was reported in 63 counties, and the leading counties were Osage, Stephens, Garvin, Carter, Kingfisher, and Creek. Unallocated fields, which included secondary-recovery projects and stripper wells, accounted for 59 percent of the total output.

Estimated proved recoverable reserves of crude oil amounted to 1,787 million barrels as of January 1, according to the American Petroleum Institute, a decrease of 3 million barrels from January 1, 1961. The reserve was equivalent to nearly 9 barrels of recoverable crude oil underground for each barrel of oil produced in 1962. Exploratory drilling added 4.5 million barrels to the proved oil reserve. Development drilling added 132.5 million barrels. Oklahoma had 6 percent of total U.S. oil reserves and 5 percent of the total liquid fuel reserves.

TABLE 9.—Production of crude petroleum, by fields

(Thousand barrels)

Field [1]	1958	1959	1960	1961	1962 [2]
Allen	1,590	1,676	1,525	1,403	1,390
Bradley	2,741	2,898	2,631	3,048	3,273
Burbank	14,548	14,463	15,676	15,275	14,290
Cement	4,405	4,222	3,836	4,038	3,533
Cumberland	1,474	1,407	1,219	1,213	1,142
Cushing	2,702	2,585	2,515	2,537	2,629
Dover-Hennessey				4,841	8,945
Doyle	2,421	2,241	1,798	1,671	1,313
Eola-Robberson	3,188	3,863	3,470	3,624	3,444
Glenn Pool	2,773	3,164	3,200	3,368	3,490
Golden Trend	13,106	10,627	11,071	10,202	10,730
Healdton	2,331	2,256	2,154	2,353	2,513
Hewitt	3,084	2,977	2,938	2,989	2,550
Holdenville-East	476	412			1,210
Joiner City		395	1,561	2,054	1,980
Knox	1,045	941	2,206	2,039	1,390
Lincoln				424	1,395
Loco	1,372	1,290	1,309	1,517	1,738
Moore-West	2,553	1,527	1,275	1,294	1,066
Naval Reserve	1,498	1,667	2,353	2,456	2,367
Oklahoma City	3,290	3,050	2,851	2,617	2,381
Payson-East	300	423	893	2,390	2,005
Seminole:					
Bowlegs	619	665	905	1,125	1,240
St. Louis	1,410	1,379	1,422	1,449	1,440
Sho-Vel-Tum	25,823	25,175	24,227	24,510	24,350
West Edmond	1,153	1,013	1,407	1,212	1,179
Other fields	106,797	107,774	100,471	93,432	95,633
Total	200,699	198,090	192,913	193,081	198,616

[1] Based on Oil and Gas Journal data adjusted to Bureau of Mines total.
[2] Preliminary figures.

The Interstate Oil Compact Commission in cooperation with the National Stripper Well Association, reported that on January 1, Oklahoma had 68,740 stripper wells which produced over 116 million barrels of oil in 1961. Oil reserves of stripper wells totaled 1.3 billion barrels or 72 percent of the overall proved oil reserves in Oklahoma on January 1.

The average price per barrel of crude petroleum at the wellhead was $2.92, up from $2.91 in 1961.

Oklahoma had 14 refineries with a total daily capacity of 409,380 barrels of crude oil and 245,770 barrels of cracked gasoline on January 1. The refineries processed about 67 percent of the State production in 1962. Crude oil runs to stills, compared with total receipts, intrastate receipts, and yearend stocks at Oklahoma refineries for 1961 and 1962, in thousand barrels, were as follows:

Year	*Runs to stills*	*Total receipts*	*Intrastate receipts*	*Stocks Dec. 31*
1961	130,276	129,788	93,387	2,021
1962	133,387	133,331	102,072	1,981

Changes in various refinery capacities during 1962 were as follows: At Stroud, Allied Materials Corp. reduced crude capacity from 4,400 to 4,200 barrels per stream day (BPSD), decreased vacuum distillation from 2,500 to 2,000 BPSD, reduced asphalt production from 2,000 to 1,000 BPSD, and added 850 BPSD of lube oil production to its plant. Champlin Oil & Refining Co. increased vacuum distillation from 19,700 to 20,000 BPSD and boosted coke production from 100 to 150 tons per stream day at its Enid refinery. Kerr-McGee Oil Industries, Inc., further decreased crude capacity from 20,000 to 7,500 BPSD

TABLE 10.—Oil and gas wells drilled in 1962, by counties

County	Proved field wells				Exploratory wells			Total
	Oil [1]	Gas	Service	Dry	Oil [1]	Gas	Dry	
Adair							1	1
Alfalfa	12	1		4	1	2	5	25
Atoka	8			1			4	13
Beaver	137	65		61	2		6	271
Beckham	5	1		11			1	18
Blaine	3	9		4	1		6	23
Bryan	4	4		1			1	10
Caddo	16	1	2	6	1		3	29
Canadian				1	2	1	6	10
Carter	151	2	11	41			8	213
Cherokee							2	2
Cimarron	8	7		6	2		1	24
Cleveland	32		2	18	5		10	67
Coal	1	1	1	3	1	1	4	12
Comanche	11	2	5	16		1		35
Cotton	31	2	8	15		1	7	64
Craig	1			2			2	5
Creek	148	2	122	32	1		5	310
Custer	5	1		3	1	1	1	12
Dewey	29	14		8	3		6	60
Ellis	4	23		14		3	2	46
Garfield	53	1	15	15	12	1	4	101
Garvin	70	2	7	39	1	1	3	123
Grady	13	2		9	1		3	28
Grant	32	6	2	16	3	1	9	69
Greer	5			2			3	10
Harper	9	26		18		2	3	58
Haskell		12		1		2	4	19
Hughes	30	25	2	26	1		5	89
Jefferson	21		2	13			9	45
Kay	51	17	1	41	2	1	20	133
Kingfisher	324	10		13	13		4	364
Kiowa	11			19			5	35
Latimer		24		1		2	1	28
Le Flore		7		3			2	12
Lincoln	62	26	3	32	2	1	5	131
Logan	5	3	3	8	3	1	11	34
Love	6	1		8		1	4	20
Major	50	32		11		2	6	101
Marshall	18			16			1	35
McClain	70	2		11	6		8	97
McCurtain							1	1
McIntosh		4		3		1	5	13
Murray	21	1		6	1		6	35
Muskogee	102	1	46	33		2	5	189
Noble	24	9	2	16	2	1	8	62
Nowata	60		36	24	1		1	122
Okfuskee	35	10	2	39	2	1	9	98
Oklahoma	3	2	1	12	2		2	22
Okmulgee	117	10	14	43			1	185
Osage	171	9	124	64	2		7	377
Pawnee	18		12	12	1		4	47
Payne	21	1	1	12	2	1	8	46
Pittsburg		2		1		2	4	9
Pontotoc	33	2		20		1	3	59
Pottawatomie	55		6	17	1		4	83
Pushmataha							2	2
Roger Mills						1		1
Rogers	44		61	18				123
Seminole	97	3	7	36	2		2	147
Sequoyah							1	1
Stephens	80	4	16	42	2	1	6	151
Texas	74	24	3	35	3	1	7	147
Tillman	2			5			1	8
Tulsa	57	1	35	10				103
Wagoner	23	1		44			2	70
Washington	138		95	26				259
Washita						1	1	2
Woods	1	13		4	1	3	11	33
Woodward	1	4		7	1	4	9	26
Total:								
1962	2,613	432	647	1,078	87	45	301	5,203
1961	2,803	462	775	1,276	96	52	381	5,845

[1] Includes distillate wells.

Source: Oil and Gas Journal, v. 61, No. 4, Jan. 28, 1963, pp. 213-214.

at its Cushing refinery; as in 1961, the company produced only high-quality lubricating oils. Midland Cooperatives, Inc., was increasing crude capacity from 13,000 to 15,000 BPSD at its Cushing refinery with completion expected early in 1963. At Tulsa, Texaco, Inc., increased crude capacity by 2,000 barrels per calendar day (BPCD), and vacuum distillation from 12,000 to 12,500 BPCD.

Pipelines.—The Bureau of Mines in a triennial report stated that Oklahoma had 21,599 miles of petroleum pipeline in place on January 1, 1959, and 21,534 miles in place on January 1, 1962.[3] Some 1,367 miles of pipe was laid during the 3-year period and 1,432 miles of pipe were taken up for a net change of minus 65 miles. Gathering lines for crude oil and natural gasoline totaled 13,158 miles on January 1, 1959, and 13,029 miles on January 1, 1962. Product pipelines also decreased in the same period from a total of 3,570 miles to 3,470 miles. Mileage of crude trunklines reportedly increased 112 miles to 5,738 miles in the 3-year period.

Cherokee Pipe Line Co. completed a 127-mile petroleum products pipeline from Oklahoma City to Wichita Falls, Tex. At Oklahoma City, the line connected with the Cherokee Pipe Line Co. lateral line from Ponca City. At Wichita Falls, the line connected with the Continental Oil Co. products line to Grapevine, near Dallas, Tex. Initial daily capacity was 20,000 barrels to Wichita Falls. The Continental Pipe Line Co. completed a 36-mile, 8-inch crude line from the Hennessey producing area in Kingfisher County to Orlando, Okla., where it connected with the company's main crude line to the Continental Oil Co. Ponca City refinery. An existing company pipeline operating at capacity in the area necessitated a limit of 75 percent of allowed production to producers along the system. Capacity of the new line was 30,000 barrels. Mid-Continent Pipe Line Co. completed a 25-mile, 4-inch crude oil gathering line from its Bald Hill station to the reactivated Muskogee Field. Crude oil would be moved through the Mid-Continent Pipe Line system to the Sunray DX Oil Co. Tulsa refinery for processing. Plans to build a 180-mile, 30-inch pipeline from Blackwell to Glazier, Tex., were reported by Trans-Cities Pipeline Co., a new company jointly owned by Cities Service Gas Co. and Transwestern Pipeline Co. The proposed $20 million natural gas pipeline would connect two systems.

Plans to construct the first natural gas trunkline for the Arkoma basin in eastern Oklahoma were announced by Arkansas-Louisiana Gas Co. The 16-inch gasline would extend about 200 miles from the Coal County Centrahoma gasfield northeastward through Pittsburg, Latimer, Haskell, and Le Flore Counties, thence into Arkansas. Other fields that would be served by the line would include the Red Oak, Spiro, and Wilburton fields. Panhandle Eastern Pipe Line Co. announced plans to build a 200-mile pipeline from its present line at Haven, Kans., southward into Oklahoma through the Laverne area to the Elk City field, following the acceptance by Shell Oil Co. of a Federal Power Commission order to cut prices on Shell's Elk City field gas.

Cities Service Gas Co. built a 23-mile, 16-inch pipeline between two points in Noble and Garfield Counties to move natural gas from the

[3] Messner, Walter G. Crude-Oil and Refined-Products Pipeline Mileage in the United States, Jan. 1, 1962, Mineral Industry Survey, Aug. 20, 1962, 9 pp.

Ringwood field in Major County into the transmission system of Cities Service Gas Co. Other crude oil pipelines were extended into new areas formerly dependent upon truck transportation to markets.

NONMETALS

Ten nometals produced in 1962 were valued at $46.9 million, nearly 6 percent of the total mineral production value of the State. Of the five principal nonmetal commodities—cement, clays, gypsum, sand and gravel, and stone—only cement and gypsum production increased in quantity and value. Stone output decreased in quantity and increased in value, output of lime remained about the same as 1961 but value increased, and clays and sand and gravel production declined both in quantity and value. Despite three recessions which affected the economy and mineral industry of the State in the past decade, output of the principal nonmetals increased. From 1953 to 1962, the total value of nonmetallic minerals and commodities increased nearly 106 percent.

Cement.—Output of cement by three companies at four locations was 6 percent greater, and value of shipments was 2 percent greater than in 1961. Oklahoma Cement Co. completed at Pryor a $5 million expansion which doubled production capacity, raising it to 2 million barrels per year. Plants at Ada in Pontotoc County, Pryor in Mayes County, and near Tulsa in Rogers County were active during the year. The Dewey plant of Dewey Portland Cement Co. Division of Martin Marietta Corp., resumed full production early in January having closed in October 1961. However, in April, the company announced a partial cutback in operations and dismissed 100 employees.

Clays.—Quantity and value of clay sold or used declined 7 percent compared with that of 1961. Clay produced in 1962 was used primarily to manufacture brick and tile and, to a lesser extent, for portland cement and expanded clay products. Brick and tile were pro-

TABLE 11.—Shipments of portland cement to Oklahoma consumers

Year	Oklahoma (thousand barrels)	Change, percent	
		In Oklahoma	In United States
1953–57 (average)	4,603		
1958	5,131	+5	+6
1959	5,374	+5	+9
1960	4,669	−13	−7
1961	5,573	+19	+3
1962	5,941	+7	+3

TABLE 12.—Clays sold or used by producers[1]

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	618	$778	1960	734	$739
1958	576	579	1961	792	801
1959	966	970	1962	737	756

[1] Excludes bentonite.

duced in Creek, Custer, Garfield, Greer, Lincoln, Oklahoma, Pittsburg, Pontotoc, Rogers, Seminole, and Tulsa Counties; expanded clay aggregate was produced in Oklahoma and Rogers Counties; and pottery was manufactured in Creek County. Bentonite was produced in Dewey County for filtering and absorbent uses.

Gem Stones.—Small quantities of gem-quality stones, primarily crystalline specimens of barite, calcite, marcasite, and quartz, were collected.

Gypsum.—Output of crude gypsum increased moderately in 1962 to over 509,000 short tons valued at nearly $1.7 million. United States Gypsum Co., a major producer, operated several quarries and a plant at Southard, Blaine County, to manufacture wallboard and other plaster products. Gypsum was produced by other operators in Blaine, Caddo, Canadian, Custer, and Washita Counties, for agricultural use and, to a lesser extent, as a retarder in portland cement.

Lime.—Production of lime in Sequoyah County by St. Clair Lime Co. increased 11 percent above 1961. Output was used mostly by chemical plants in Pryor and by municipal water plants. The State highway department experimented with lime to stabilize subgrade soil in road base construction and in completed roads.

Pumice.—Output and value of pumice were 9 percent and 23 percent, respectively, below the 1961 totals. Principal use was for abrasive-type cleaners.

Salt.—In Harmon County, salt was produced by solar evaporation of brine from springs, and in Woods County, from surface encrustations on the Big Salt Plain of the Cimarron River. Principal uses were for stockfeed and recharging of water softeners; other uses included herbicides and salinity control of oil well drilling fluid.

Sand and Gravel.—Choctaw, Johnston, Muskogee, Oklahoma, Pontotoc, Pushmataha, and Tulsa Counties supplied 68 percent of the quantity and 76 percent of the value of sand and gravel produced in 31 counties during 1962. Truck transportation was used for 81 percent of the sand and gravel shipped by commercial producers, and the remaining 19 percent was hauled by rail. Sand was used principally as building, paving, fill, and high-purity glass sand. Gravel was used largely for paving and building.

TABLE 13.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	3,315	$3,504	2,212	$1,028	5,527	$4,532
1958	4,245	4,417	2,987	1,442	7,232	5,859
1959	4,376	4,988	1,626	939	6,002	5,927
1960	4,823	6,544	1,601	924	6,424	7,468
1961	4,029	4,515	1,281	998	5,310	5,513
1962	3,802	4,355	634	381	4,436	4,736

Stone.—Output of stone, including limestone used to manufacture cement and lime, was 2 percent below 1961, yet value was 14 percent greater. Tulsa, Comanche, Murray, Mayes, Sequoyah, and Pontotoc

TABLE 14.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,690	$1,352	1,667	$1,420
Paving	885	732	870	749
Fill	392	203	486	220
Other [1]	480	1,642	347	1,442
Total	3,447	3,929	3,370	3,831
Gravel:				
Building	79	102	116	179
Paving	493	479	310	338
Other [2]	10	5	6	7
Total	582	586	432	524
Total sand and gravel	4,029	4,515	3,802	4,355
Government-and-contractor operations:				
Sand:				
Building	351	431	----	----
Paving	419	249	391	186
Other [3]	8	7	----	----
Total	778	687	391	186
Gravel:				
Paving	499	309	241	194
Fill	4	2	2	1
Total	503	311	243	195
Total sand and gravel	1,281	998	634	381
Grand total	5,310	5,513	4,436	4,736

[1] Includes glass, molding, filtering, and other construction, industrial, and ground sand.
[2] Includes miscellaneous gravel and other construction gravel.
[3] Other construction sand (1961).

TABLE 15.—Sand and gravel production in 1962, by counties

County	Short tons	Value	County	Short tons	Value
Alfalfa	18,807	$16,456	Noble	36,500	$32,850
Atoka	24,183	9,674	Oklahoma	401,477	410,696
Blaine	80,231	120,347	Pawnee	139,946	96,845
Bryan	107,146	72,250	Pottawatomie	69,754	71,977
Caddo	2,743	4,064	Pushmataha	147,364	174,146
Choctaw	326,752	356,558	Texas	9,720	10,800
Greer	132,815	79,405	Tillman	4,576	2,495
Kay	81,281	35,652	Tulsa	1,146,718	706,620
Kiowa	48,000	43,200	Woodward	22,168	15,515
Le Flore	2,760	2,760	Other counties [1]	1,604,675	2,447,343
Logan	11,745	5,360	Total	4,436,053	4,735,990
McCurtain	3,692	1,477			
Murray	13,000	19,500			

[1] Includes Grady, Jackson, Johnston, Kingfisher, McIntosh, Major, Muskogee, Pontotoc, and Woods Counties, combined to avoid disclosing individual company confidential data. Undistributed amounts from various counties are also included.

Counties accounted for 60 percent of all stone produced in the State and 58 percent of the value. Limestone comprised 86 percent of the total stone produced and sandstone 7 percent; the remaining 7 percent was granite and chat. Most of the stone output was crushed and used for roadstone, concrete aggregate, and the manufacture of cement

TABLE 16.—Stone sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Granite		Limestone		Sandstone		Other stone		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1958	31	$569	9,383	$10,833	275	$264	1,105	$566	10,794	$12,232
1959	[1] 5	720	11,242	13,455	222	241	1,214	564	12,683	14,980
1960	[2] 5	620	11,995	13,852	784	870	1,270	756	[2] 14,054	[2] 16,098
1961	22	681	12,531	13,712	1,133	1,529	1,295	639	14,981	16,561
1962	15	1,043	12,579	15,793	1,040	1,351	1,032	632	14,666	18,819

[1] Crushed granite included with "Other stone."
[2] Excludes crushed granite.

and lime. Open-pit methods accounted for all stone produced except the output from two underground mines in eastern Oklahoma. Trucks carried 54 percent of the stone shipments; railroads, 7 percent; and unspecified transportation, 39 percent.

Chat.—Essentially chert with small quantities of limestone, galena, sphalerite, marcasite, and pyrite, chat is the coarse tailing from milling lead and zinc ores in the Tri-State District. Most of the chat was sold for railroad ballast, concrete aggregate, and road surfacing.

Granite.—Seven quarries were operated by five producers in the Wichita Mountains area of Greer and Kiowa Counties, center of the State's dimension-granite industry. Two producers operated in Johnston County. Output was 77 percent greater than that of 1961 and was predominantly pink and red Precambrian granites. Most of the dimension granite used for monumental stone was finished in plants within the area; the remainder was shipped to other States for finishing.

Limestone and Dolomite.—Limestone and dolomite were quarried in 31 counties; Tulsa, Comanche, and Murray Counties reported the greatest output. Chemical-grade limestone quarried at Marble City, Sequoyah County, was used as a flux in glass manufacture, for making lime, and for agriculture. Dimension limestone was quarried in Caddo, Johnston, and Pontotoc Counties for building stone, curbing, and flagging. Limestone for portland and masonry cement was quarried in Pontotoc, Rogers, Mayes, and Washington Counties. Dolomite was quarried in Johnston County for use as a flux in glass manufacturing and as a soil conditioner.

Sandstone.—Output of sandstone, quarried in six counties, was 8 percent below that of 1961. The crushed sandstone was used by the State highway department and the U.S. Army Corps of Engineers, Tulsa District.

Sulfur.—Central Chemical Co., Madill, Marshall County, recovered sulfur from refinery offgas of sour crude gas. Output declined 42 percent.

Tripoli.—Output of tripoli in eastern Ottawa County increased 21 percent. The crude material was processed at Seneca, Mo., by American Tripoli Division of The Carborundum Co. and sold primarily for buffing compounds and in minor quantities for foundry use.

Vermiculite.—Texas Vermiculite Co. exfoliated vermiculite at its plant in Oklahoma County from material mined in other States. The product was used mainly in concrete and plaster.

Water.—A longstanding water-pollution problem on Pryor Creek ended in June when the Pryor Industrial Conservation Corp., a cooperative project of Bestwall Products Co., John Deere Chemical Co., and National Gypsum Co., completed a $500,000 industrial-waste disposal system to control the rate of discharge into the Grand River in Mayes County. The system consisted of 4.5 miles of concrete pipeline which connects the three plants with two hold lagoons and the Grand River. Automatic control, proportioned to the stream flow, assured adequate and safe diffusion at all stream levels.

The results of a joint survey conducted by the U.S. Army Corps of Engineers, Tulsa District, and the Public Health Service, U.S. Department of Health, Education, and Welfare, indicated that 6,000 to 10,000 tons of salt seeps into the Arkansas River each day. The Arkansas and Cimarron Rivers flowing through the Big Salt Plains and the Great Salt Plains in western Oklahoma were the principal sources of the salt.

The University of Oklahoma was awarded a $47,567 contract by the U.S. Department of the Interior for work on saline water conversion research and development.

Three multimillion-dollar dam projects of the U.S. Army Corps of Engineers, Tulsa District, were in various stages of construction at yearend. Eufaula Dam, under construction on the South Canadian River between Haskell and McIntosh Counties, 12 miles east of Eufaula, was over 50 percent complete. The completion of the $120 million project was scheduled for 1965. Keystone Dam, under construction on the Arkansas River in Tulsa County, 15 miles west of Tulsa, was more than 60 percent complete. The last concrete was put in place on the spillway late in September. This $127 million project also was scheduled to be finished in 1965. The Oologah Dam, under construction on the Verdigris River in Rogers County, 27 miles northeast of Tulsa, was virtually completed. Originally scheduled for completion in late 1962, the $35 million project was expected to be finished early in 1963.

Ground was broken on January 1 for the construction of the Grand River Dam Authority (GRDA) Markham Ferry project on the Grand River in Mayes County, 12 miles southeast of Pryor. The project, estimated to cost approximately $36 million, was scheduled to be in operation by June 1964. After unsuccessful efforts to relocate 18 miles of the Kansas, Oklahoma, & Gulf Railroad (KO&G) right of way which would be inundated when the project was completed, GRDA agreed to pay KO&G $3.1 million by January 1, 1964, for the condemned trackage. KO&G petitioned the Interstate Commerce Commission for permission to abandon its line from Okay, Okla., north to Baxter Springs, Kans., a distance of nearly 104 miles.

Bureau of Reclamation, U.S. Department of the Interior, began preconstruction activities on the $13.3 million Arbuckle reclamation project southwest of Sulphur in Murray County on Rock Creek, a tributary of the Washita River. The project would provide water for Ardmore, Davis, Sulphur, Wynnewood, and an oil refinery. Ground was broken in October for construction of the Bureau of Reclamation's Norman Dam project east of Norman on the Little River in Cleveland and Oklahoma Counties. When finished in 1965, the $18

million multipurpose project was expected to supply water to Del City, Midwest City, and Norman.

The Kaw Dam Reservoir project, above Ponca City on the Arkansas River between Kay and Osage Counties, received funds for preliminary studies on the exact location of the dam, the relocation of roads and railroads, and other details.

METALS

Lead and zinc output increased substantially as $4.6 million became available to administer Public Law 87-347—the Lead-Zinc Stabilization Program—for the first year.

Germanium.—Reclaimed as an accumulation of residue in zinc smelting, germanium was recovered from domestic and foreign ore concentrates by The Eagle-Picher Co. at Henryetta, Okmulgee County, and by National Zinc Co. at Bartlesville, Washington County. The residue was shipped to The Eagle-Picher Co. germanium processing plant north of Quapaw, Ottawa County.

Lead.—Nineteen producers reported lead output from 36 operations, compared with 15 producers at 21 operations in 1961. Output of recoverable lead in Ottawa County increased 177 percent and value rose 147 percent. The price of lead, New York, on January 1 was 10.25 cents per pound until January 5 when the price was reduced to 10 cents per pound. Effective February 1, the price dropped to 9.75 cents and on February 9, 9.5 cents, remaining at this level until November 2 when the price was raised to 10.00 cents per pound, where it held until yearend.

Zinc.—Recoverable zinc output in Ottawa County increased 218 percent in tonnage and value over 1961. Twenty producers reported zinc ore output from 40 operations, compared with 15 producers at 21 operations in 1961. The price of zinc was 12 cents per pound from January 1 until April 2, when it dropped to 11.5 cents and remained unchanged for the rest of 1962.

TABLE 17.—Mine production of lead and zinc, in terms of concentrate and recoverable metals[1]

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content[2]			
					Lead		Zinc	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1953–57 (average)	15,788	$2,720	61,152	$4,556	11,433	$3,294	32,119	$7,647
1958	5,213	689	9,791	594	3,692	864	5,267	1,074
1959	905	118	2,090	134	601	138	1,049	241
1960	1,687	155	4,715	344	936	219	2,332	602
1961	1,333	130	5,936	405	980	202	3,148	724
1962	3,600	343	18,327	1,278	2,710	499	10,013	2,303
1891–1962	1,680,331	163,307	9,762,628	484,293	1,288,378	195,112	5,147,657	775,609

[1] Based on Oklahoma ore (dirt) and old tailing treated at mills during calendar year indicated.

[2] In calculating metal content of the ores from assays, allowance made for smelting losses of both lead and zinc. In comparing values of concentrate (ore) and metal, it should be noted that value given for concentrate is that actually received by producer, whereas value of lead and zinc is calculated from average price for all grades.

TABLE 18.—Tenor of lead-zinc ore milled and concentrates produced

	1961 [1]	1962
Total material milled ---------- short tons	80,232	349,686
Recovery of concentrate and metal from quantity milled:		
Galena ---------- short tons	1,219	3,600
Sphalerite ---------- do	5,688	18,327
Galena ---------- percent	1.52	1.03
Sphalerite ---------- do	7.09	5.24
Lead [2] ---------- do	1.15	0.77
Zinc [2] ---------- do	3.78	2.86
Average lead content of galena concentrate ---------- do	77.28	76.75
Average zinc content of sphalerite concentrate ---------- do	59.28	60.70
Average value per ton:		
Galena concentrate	$100.55	$95.17
Sphalerite concentrate	$68.67	$69.75

[1] Lead-zinc concentrates from accumulated slimes excluded.
[2] Figures represent metal content of crude ore (dirt) as recovered in concentrate. Data on tailing losses not available.

TABLE 19.—Mine production of lead and zinc in 1962, by months, in terms of recoverable metals

(Short tons)

Month	Lead	Zinc	Month	Lead	Zinc
January	212	559	August	208	823
February	212	597	September	216	890
March	330	673	October	187	1,114
April	284	778	November	182	1,125
May	291	869	December	182	1,131
June	216	716			
July	190	738	Total	2,710	10,013

Custom Mills and Smelters.—The Eagle-Picher Co. at Henryetta, Okmulgee County, operated its horizontal-retort zinc plant throughout 1962. American Metal Climax, Inc., at Blackwell, Kay County, curtailed production by operating an average 10 of 12 furnace blocks. The National Zinc Co. smelter at Bartlesville, Washington County, was shut down for 2 months because of labor troubles. These smelters treated domestic and foreign ores and concentrates. A secondary zinc plant was operated by Federated Metals Division of American Smelting & Refining Co. in Sand Springs, Tulsa County.

The Barbara J. mill of American Zinc, Lead & Smelting Co. near Cardin, and the Central mill of The Eagle-Picher Co. near Commerce, custom-milled ore from the Tri-State District.

Sulfuric acid was recovered as a byproduct from imported zinc ores processed by National Zinc Co. at its plant in Bartlesville.

TRI-STATE DISTRICT

Passage of the Lead-Zinc Stabilization Act late in 1961 and the approval of over $4 million to operate the program the first year did much to boost quantities of lead and zinc concentrates recovered by 51 percent and 149 percent, respectively. Fire destroyed five small lead and zinc mills in the area and, at yearend, none had been rebuilt. Kansas produced 26 percent of the district's lead concentrate and 28 percent of its zinc concentrate, and Oklahoma produced 74 percent of the

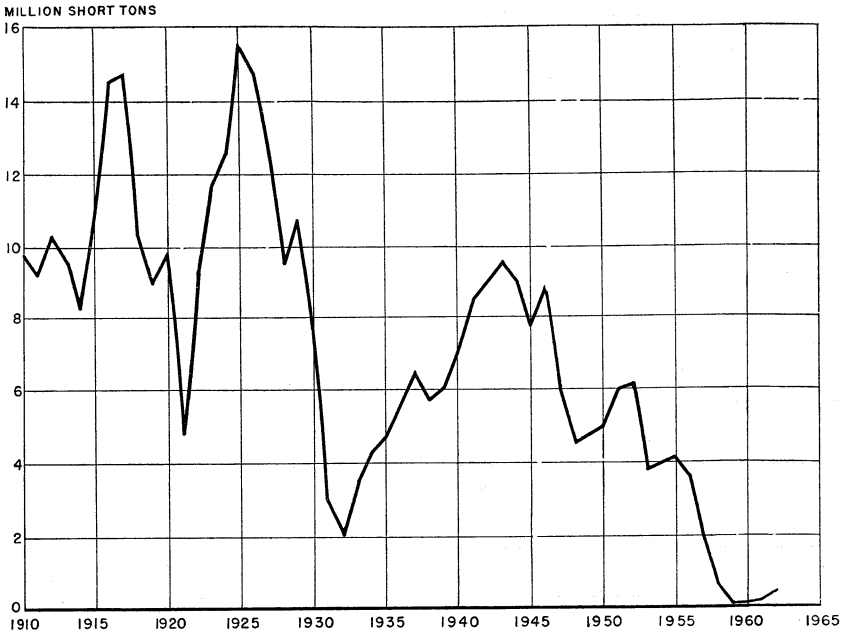

FIGURE 2.—Quantity of crude ore (rock) milled in the Tri-State District, 1910–62.

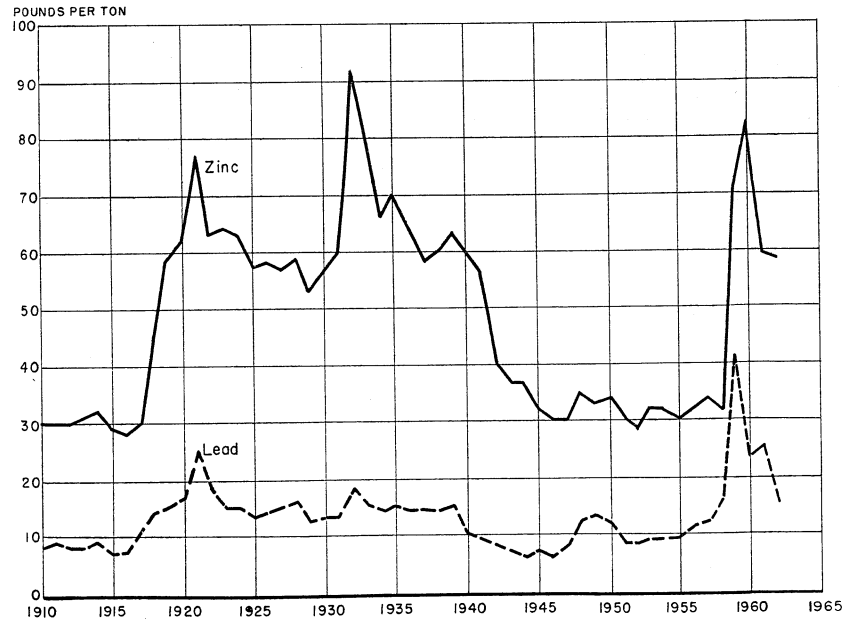

FIGURE 3.—Metal recovered per ton of crude ore (rock) milled in the Tri-State District, 1910–62.

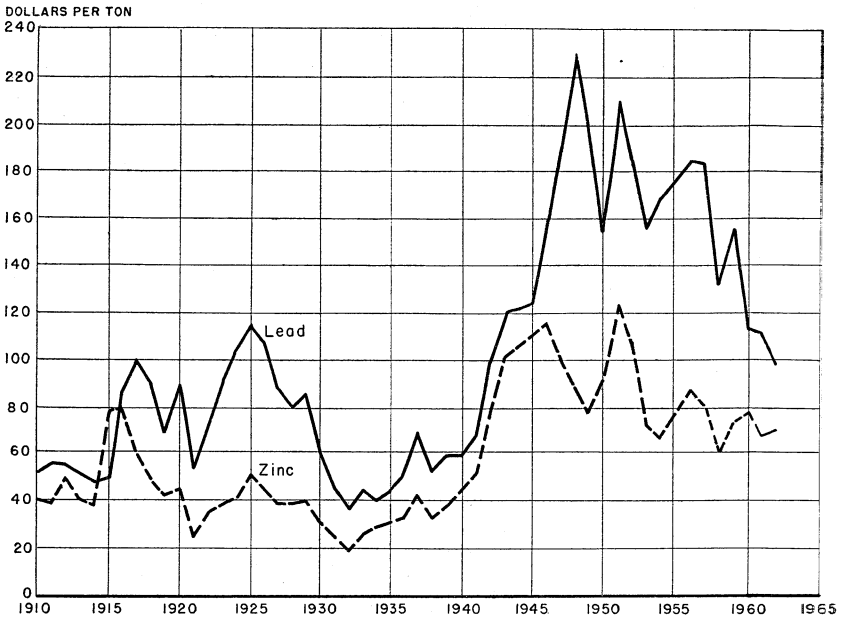

FIGURE 4.—Average prices received by sellers per ton of concentrate in the Tri-State District, 1910–62.

TABLE 20.—Mine production of lead and zinc concentrates in Tri-State District, in terms of concentrate and recoverable metals

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content			
					Lead		Zinc	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1953–57 (average)	22,684	$3,958	105,190	$7,986	16,620	$4,807	55,571	$13,340
1958	7,041	931	18,001	1,093	4,991	1,168	9,688	1,976
1959	1,607	211	4,061	282	1,082	249	2,066	475
1960	3,098	284	8,877	658	1,717	402	4,449	1,148
1961	3,243	352	10,666	716	2,429	500	5,594	1,287
1962:								
Kansas	1,290	138	7,237	493	970	178	3,943	907
Southwest Missouri								
Oklahoma	3,600	343	18,327	1,278	2,710	499	10,013	2,303
Total: 1962	4,890	481	25,564	1,771	3,680	677	13,956	3,210

district's lead concentrate and 72 percent of its zinc concentrate. No production had been reported from the part of the district in southwest Missouri since 1957.

Quoted prices on 60-percent zinc concentrates at Joplin, Mo., were $72 per short ton until April 2, when the price declined to $68 per ton for the rest of 1962, according to E&MJ Metal & Mineral Markets. Price quotations on 80-percent lead concentrate at Joplin were discontinued after November 23, 1961.

TABLE 21.—Tenor of lead and zinc ore milled and concentrates produced in the Tri-State District

	1958	1959 [1]	1960 [1]	1961 [1]	1962
Total material milled:					
Crude ore—short tons	611,556	31,750	51,972	180,331	474,219
Recovery of concentrate and metal from material milled:					
Galena—percent	1.15	2.58	1.85	1.67	1.03
Sphalerite—do	2.94	6.71	7.79	5.64	5.39
Lead [2]—do	0.82	2.05	1.18	1.28	0.78
Zinc [2]—do	1.58	3.54	4.13	2.98	2.94
Average lead content of galena concentrate—do	72.35	81.17	64.86	78.43	76.75
Average zinc content of sphalerite concentrate—do	59.76	58.54	58.88	58.65	60.64
Average value per ton:					
Galena concentrate	$132.29	$154.95	$113.62	$111.82	$98.24
Sphalerite concentrate	$60.74	$73.49	$78.40	$67.56	$69.30

[1] Lead-zinc concentrates from accumulated slimes excluded.
[2] Figures represent metal content of the crude ore (dirt) as recovered in concentrate.

REVIEW BY COUNTIES

Minerals were produced in 74 of the 77 counties. The 10 leading counties, in descending order of mineral production value, were Osage, Garvin, Stephens, Carter, Beaver, Kingfisher, Texas, Creek, Seminole, and Lincoln. Crude oil was reported from 63 counties, natural gas from 64, and natural gas liquids from 28. Nonmetals were produced in 59 counties and metals in 1 county. Only those counties with significant production or industry information are discussed in this review (see table 22 for additional details).

Beaver.—The value of mineral output rose 77 percent as a result of increased natural gas and crude oil production. Four processing plants recovered natural gas liquids from natural gas. A fifth plant, a gasoline plant capable of processing 30 million cubic feet of gas per day, was completed by Cabot Corp. Volcanic ash was mined near Gate by LaRue-Axtell Pumice Co.

Beckham.—Output of natural gas, petroleum, and natural gas liquids increased 28 percent. Natural gas and petroleum were produced mainly from the Elk City field. Natural gas liquids were extracted at the Elk City cycling plant of Shell Oil Co.

Blaine.—Gypsum was mined northeast of Watonga by Universal Atlas Cement Co. and west of Okeene by Walton Gypsum Co. United States Gypsum Co. quarried and crushed gypsum and operated a large calcining, sheetrock, and plaster products plant at Southard. Paving gravel was produced by the State highway department. Natural gas output increased substantially, and output of petroleum decreased slightly.

Bryan.—Overall mineral production value declined 3 percent. Losses in limestone and sand and gravel production offset a 4-percent gain in value of petroleum and natural gas. Building and paving sand and miscellaneous gravel were obtained from open pits by two producers and the State highway department.

Caddo.—Losses in petroleum, stone, gypsum, and sand and gravel output accounted for a minor decline in total mineral value, although the value of natural gas production gained. Petroleum and natural gas were produced from several fields. Cement, the largest field, furnished more than 3.5 million barrels of oil. APCO operated its

TABLE 22.—Value of minerals produced in Oklahoma, by counties [1]

County	1961 [2]	1962	Minerals produced in 1962 in order of value
Adair	$69,406		
Alfalfa	3,203,484	$4,022,316	Petroleum, natural gas, sand and gravel.
Atoka	(3)	(3)	Stone, petroleum, sand and gravel.
Beaver	21,726,961	38,436,185	Natural gas, petroleum, natural gas liquids, pumice.
Beckham	8,129,989	10,453,940	Natural gas, petroleum, natural gas liquids.
Blaine	2,014,395	3,435,718	Gypsum, natural gas, petroleum, sand and gravel.
Bryan	2,041,883	1,978,434	Petroleum, natural gas, sand and gravel.
Caddo	14,126,770	12,225,076	Petroleum, natural gas, stone, gypsum, sand and gravel.
Canadian	306,103	276,662	Petroleum, natural gas, gypsum.
Carter	62,621,145	51,411,982	Petroleum, natural gas liquids, natural gas, stone.
Cherokee	(3)	(3)	Stone.
Choctaw	(3)	614,558	Sand and gravel, stone.
Cimarron	7,982,879	12,391,599	Helium, natural gas, petroleum.
Cleveland	15,961,455	14,560,376	Petroleum, natural gas liquids, natural gas, stone, gem stones.
Coal	2,079,690	2,487,946	Petroleum, natural gas, stone.
Comanche	2,564,973	3,692,216	Stone, natural gas, petroleum.
Cotton	5,002,305	4,744,996	Petroleum, natural gas.
Craig	525,362	956,850	Coal, petroleum, natural gas, stone.
Creek	32,363,730	32,881,632	Petroleum, natural gas liquids, natural gas, clays, sand and gravel, stone.
Custer	613,642	1,114,025	Natural gas, petroleum, clays, gypsum.
Dewey	477,825	1,615,472	Petroleum, natural gas, clays.
Ellis	308,195	480,422	Petroleum, natural gas.
Garfield	5,864,706	7,499,343	Petroleum, natural gas, natural gas liquids, clays.
Garvin	79,158,260	67,538,721	Petroleum, natural gas liquids, natural gas.
Grady	21,331,198	17,712,026	Petroleum, natural gas, natural gas liquids, sand and gravel.
Grant	5,441,597	6,963,696	Petroleum, natural gas, natural gas liquids.
Greer	367,283	359,905	Stone, petroleum, sand and gravel, natural gas, clays.
Harmon	13,112	14,025	Salt.
Harper	12,341,889	22,521,558	Natural gas, petroleum, natural gas liquids, stone.
Haskell	3,103,741	3,348,298	Coal, natural gas.
Hughes	5,699,338	6,105,226	Petroleum, natural gas.
Jackson	595,775	1,110,203	Petroleum, sand and gravel, natural gas.
Jefferson	3,964,482	3,285,803	Petroleum, natural gas.
Johnston	(3)	(3)	Sand and gravel, stone.
Kay	14,321,535	13,259,946	Petroleum, natural gas liquids, natural gas, stone, sand and gravel.
Kingfisher	14,716,598	35,908,739	Petroleum, natural gas, natural gas liquids, sand and gravel.
Kiowa	1,862,065	1,731,334	Stone, petroleum, natural gas, sand and gravel.
Latimer	213,639	363,479	Natural gas.
Le Flore	1,438,793	1,323,703	Natural gas, coal, sand and gravel.
Lincoln	26,757,578	26,120,271	Petroleum, natural gas, natural gas liquids, clays, stone.
Logan	7,344,937	7,003,619	Petroleum, natural gas, natural gas liquids, sand and gravel.
Love	6,657,756	8,013,135	Petroleum, natural gas liquids, natural gas.
Major	4,729,949	6,272,413	Petroleum, natural gas liquids, natural gas, sand and gravel.
Marshall	6,679,094	5,897,373	Petroleum, natural gas liquids, natural gas, stone.
Mayes	(3)	(3)	Cement, stone, clays, petroleum.
McClain	27,191,098	24,871,053	Petroleum, natural gas, natural gas liquids.
McCurtain	1,027,905	104,393	Stone, sand and gravel, gem stones, petroleum.
McIntosh	806,825	738,785	Stone, natural gas, sand and gravel, coal, petroleum.
Murray	2,161,104	2,002,275	Stone, petroleum, sand and gravel, natural gas.
Muskogee	2,691,680	3,118,511	Petroleum, sand and gravel, natural gas.
Noble	9,621,674	9,049,772	Petroleum, natural gas, natural gas liquids, sand and gravel.
Nowata	6,136,601	5,344,977	Petroleum, stone, natural gas.
Okfuskee	9,405,183	8,694,071	Petroleum, natural gas, natural gas liquids.
Oklahoma	23,489,685	22,477,789	Petroleum, natural gas liquids, natural gas, sand and gravel, clays.
Okmulgee	6,919,119	5,737,583	Petroleum, natural gas, coal.
Osage	73,930,152	75,009,255	Petroleum, stone, natural gas liquids, natural gas.
Ottawa	1,656,536	3,483,855	Zinc, stone, lead, tripoli.
Pawnee	5,543,835	5,501,521	Petroleum, sand and gravel, natural gas, stone.
Payne	8,691,210	7,801,944	Petroleum, natural gas, stone, natural gas liquids.
Pittsburg	1,331,621	2,355,793	Coal, stone, natural gas, clays.
Pontotoc	21,237,799	21,506,772	Cement, petroleum, stone, sand and gravel, natural gas liquids, clays, natural gas.
Pottawatomie	12,192,312	12,467,118	Petroleum, natural gas liquids, natural gas, stone, sand and gravel.
Pushmataha	1,115,503	174,146	Sand and gravel.
Rogers	6,504,966	8,788,157	Cement, petroleum, coal, stone, clays, natural gas.
Seminole	28,587,667	26,572,471	Petroleum, natural gas liquids, natural gas, stone, clays.
Sequoyah	1,943,799	2,391,626	Stone, lime, coal, natural gas.
Stephens	69,559,497	61,204,384	Petroleum, natural gas, natural gas liquids, stone.

See footnotes at end of table.

TABLE 22.—Value of minerals produced in Oklahoma, by counties[1]—Continued

County	1961[2]	1962	Minerals produced in 1962 in order of value
Texas	$24,150,923	$33,250,896	Natural gas, petroleum, natural gas liquids, sand and gravel.
Tillman	2,066,996	1,499,677	Petroleum, sand and gravel.
Tulsa	8,293,021	7,917,843	Petroleum, stone, sand and gravel, clays, natural gas.
Wagoner	742,626	527,560	Petroleum, natural gas.
Washington	20,522,544	14,307,326	Petroleum, cement, stone, clays, natural gas.
Washita	829,186	736,758	Natural gas, petroleum, gypsum.
Woods	741,150	1,043,730	Natural gas, petroleum, salt, sand and gravel.
Woodward	580,370	1,347,409	Natural gas, petroleum, sand and gravel.
Undistributed	7,380,896	33,111,329	
Total	791,777,000	843,272,000	

[1] Delaware and Roger Mills Counties are not listed because no production was reported.
[2] Revised figures.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

12,000-barrel-per-day refinery at Cyril throughout the year. Harrison Gypsum Co. strip-mined gypsum near Lindsay for portland cement and agricultural uses. Dimension and crushed limestone were produced. Bulding sand was produced by one operator.

Carter.—The county ranked fourth in total mineral value and production of natural gas liquids and petroleum. Petroleum and natural gas were produced from numerous fields; Fox-Graham, Healdton, Hewitt, and Sho-Vel-Tum fields were the largest. The Sho-Vel-Tum field was the Nation's third largest producing field. Six plants extracted natural gas liquids. Bell Oil & Gas Co. operated the Ben Franklin Refinery Co. refinery at Ardmore.

Cimarron.—A 55-percent increase in total mineral value resulted from increased natural gas and petroleum production and from the sale of helium. Although production of helium declined 7 percent, value increased 69 percent because the price of helium was raised in November 1961 under the Helium Act (Public Law 86–777). Helium was extracted at the Bureau of Mines Keyes plant from natural gas supplied by Colorado Interstate Gas Co. About mid-October the 425 mile helium pipeline from Bushton, Kans., to the Government gas storage field at Cliffside near Amarillo, Tex., was completed, and much of the subsequent helium production was used to fill the line. Several fields in the Keyes area produced natural gas and petroleum.

Cleveland.—Natural gas liquids were recovered at plants operated by Continental Oil Co. and Sunray DX Oil Co. (formerly Sunray Mid-Continent Petroleum Corp.). Sandstone was quarried and crushed for use by the State highway department.

Comanche.—Dolese Bros. Co. produced crushed limestone at its Richards Spur quarry north of Lawton. Natural gas and petroleum were produced from a group of small fields (comprising three districts) and the Fort Sill Reservation field.

Craig.—Total mineral value increased 82 percent as the result of increased coal production. Four operators strip-mined coal at seven pits. Limestone was quarried and crushed for use by the State highway department.

Creek.—Petroleum and natural gas were produced from numerous fields. The prolific Cushing and Glenn Pool furnished more than 6

million barrels of petroleum. Natural gas liquids were recovered at processing plants operated by Kerr-McGee Oil Industries, Inc., Sinclair Oil & Gas Co., and Warren Petroleum Corp. At Sapulpa, clay for manufacturing brick and tile was produced by Sapulpa Brick & Tile Co. and clay for pottery by Frankoma Pottery Co. Limestone was quarried and crushed by one producer.

Custer.—Total mineral value gained as increased natural gas and petroleum production counteracted losses in the output of stone, clay, and gypsum. Clay for brick and tile was produced by Acme Brick Co. Gypsum for agricultural use was strip mined by Southwestern Gypsum Co. Keener Oil Co. shut down in May and abandoned its Bartlett cycling plant, which formerly extracted gas liquids from natural gas, near Butler.

Garfield.—A 28-percent increase in total mineral value resulted from increased production of petroleum, natural gas, and clay. Sinclair Oil & Gas Co. recovered natural gas liquids from its Garber field plant at Covington. Champlin Oil & Refining Co. operated its 32,000-barrel-per-day refinery at Enid. The capacity of the refinery's delayed coking unit was increased 50 percent. Clay was mined for brick manufacturing by Enid Brick & Tile Manufacturing Co.

Garvin.—The county dropped to second place in the total value of minerals produced, with a 15-percent decrease from the 1961 total. A 73-percent loss in natural gas production was primarily responsible. About 16.3 million barrels of petroleum were produced. Natural gas liquids were recovered in plants operated by O. H. Grimes, Lone Star Gas Co., Phillips Petroleum Co., Service Gas Products Co., Sohio Petroleum Co., and Warren Petroleum Corp. Kerr-McGee Oil Industries, Inc., operated its 24,000-barrel-per-day refinery at Wynnewood throughout 1962.

Grady.—Production losses in petroleum, natural gas, natural gas liquids, and stone were responsible for a 17-percent decline in total mineral value. British-American Oil Producing Co. began a pressure maintenance and cycling program in the unitized Knox-Bromide field of Grady and Stephens Counties. Natural gas liquids were recovered by British-American Oil Producing Co. and Cyprus Mines Corp. processing plants and Mobil Oil Co. cycling plant. The Dolese Co. obtained sand for building and paving from pits near Tuttle.

Grant.—Increased output of petroleum, natural gas, and natural gas liquids accounted for a 28-percent gain in mineral value. Natural gas liquids were recovered by Continental Oil Co. at its Medford plant.

Harper.—Total mineral value gained 82 percent owing to increased production of natural gas, petroleum, natural gas liquids, and stone. The Sun Oil Co. gasoline plant processed gas from the large Laverne gasfield to recover gas liquids.

Haskell.—An increase in value of natural gas offset a 4-percent decrease in value of coal production and raised the total value by 8 percent. Haskell County retained first place in value of coal produced, and four operators produced coal from five open-pit operations.

Johnston.—Pennsylvania Glass Sand Corp. of Oklahoma produced sand for glass and ground silica from pits north of Mill Creek. Dimension limestone for building was produced near Pontotoc by Ada Stone Co., and crushed limestone for road construction was pro-

duced by Rock Products Corp. Dimension granite was produced by two operators.

Kay.—Total mineral value declined 7 percent because of losses in petroleum, natural gas liquids, natural gas, and sand production. Petroleum and natural gas were produced from numerous fields and natural gas liquids were recovered at plants of Cities Service Oil Co. and Wunderlich Development Co. At Ponca City, petroleum refineries of Cities Service Oil Co. and Continental Oil Co. operated throughout the year. Petrochemical units of the Continental Oil Co. refinery produced benzene, toluene, propylene hydrocarbons, and carbon black. Crushed limestone was produced northeast of Ponca City by Standard Industries, Inc., at its quarry and plant purchased from Cookson Stone Co. Sand for building, paving, and fill was produced by Sober Brothers Concrete, Inc., at Blackwell, and by Sober Brothers Sand & Gravel Co. at Ponca City. Blackwell Zinc Co., Inc., a division of American Metal Climax, Inc., operated its zinc smelter at reduced capacity during the last half of the year.

Kingfisher.—A 144-percent gain in total mineral production value raised the county to 6th place (16th in 1961). The substantial rise resulted from large increases in production of petroleum, natural gas, and natural gas liquids. Three natural gas liquids recovery plants placed on stream in 1962 were the Continental Oil Co. 30-million-cubic-foot-per-day plant at Hennessey, the Humble Oil & Refining Co. 77-million-cubic-foot-per-day Dover-Hennessey plant, and the Pan American Petroleum Corp. 32-million-cubic-foot-per-day plant at North Okarche. Petroleum allowable restrictions were removed when Continental Pipe Line Co. completed a 36-mile, 8-inch crude line from the Hennessey producing area to Orlando, Logan County, for pipeline connections to the company's refinery at Ponca City. An existing company pipeline operating at capacity in the area necessitated a limit of 75 percent of allowed production to producers along the system. The Dolese Co. produced sand for building and paving uses from pits near Dover.

Kiowa.—Dimension granite was quarried near Snyder by three operators and near Hobart by Century Granite Co. Roosevelt Materials Co. produced crushed limestone for concrete aggregate. Southwest Sand Co. produced sand for building use.

Le Flore.—Total mineral value declined slightly because coal production dropped appreciably even though natural gas value increased substantially. Four operators produced coal from underground operations, compared with seven in 1961. As a result of reduced output, the county dropped to fifth place in value of coal production. Paving sand and gravel were produced for highway surfacing.

Lincoln.—Numerous fields produced petroleum and natural gas. Four plants extracted natural gas liquids from natural gas. The Allied Materials Corp. 4,000-barrel-per-day refinery at Stroud operated during the year. Clay for building brick was produced by Stroud Clay Products Co.

Logan.—Petroleum and natural gas were produced from numerous fields and natural gas liquids were recovered at the cycling plant of Eason Oil Co. Building sand was produced by John McConnell.

Love.—Texaco, Inc., placed on stream its 23-million-cubic-foot-per-day natural gas processing plant in the Southwest Enville field near

Marietta. Sand and gravel was produced for the State highway department.

Major.—Petroleum and natural gas were produced primarily from the Ringwood field. Natural gas liquids were recovered by National Fuels Corp. at the Ringwood plant formerly operated by Warren Petroleum Corp. Construction sand was produced by Orin Law.

Marshall.—Petroleum and natural gas were produced from several fields. The most important field was the Cumberland field which yielded over 1 million barrels of oil. Natural gas liquids were recovered at plants of National Fuels Corp. (formerly Warren Petroleum Corp.) and Service Gas Products Co. Near Madill, sulfur from sour gas was recovered by Central Chemical Co. Limestone was quarried and crushed by one operator.

Mayes.—Limestone and clay were produced for cement manufacture by Oklahoma Cement Co. at its plant southeast of Pryor. The company completed a $5 million expansion which doubled plant capacity. Crushed limestone was quarried for roadstone, concrete aggregate, and agricultural stone by the State highway department and Standard Industries, Inc. A small quantity of petroleum was produced. Construction of the Markham Ferry project on the Grand River 12 miles southeast of Pryor was begun the first of the year by GRDA. At yearend progress on the dam was ahead of schedule.

McClain.—Petroleum and natural gas were produced at numerous small fields, and natural gasoline was recovered at the Criner plant of Sunray DX Oil Co.

McIntosh.—Limestone and sandstone were quarried and crushed for use as concrete aggregate and roadstone and for use by the U.S. Army Corps of Engineers, Tulsa District, on the Eufaula dam. Value of coal output was substantially below 1961. Natural gas and petroleum were produced, mainly from the Coalton and Stidham fields. Sand was produced for fill purposes by Fyfe Sand & Gravel Co.

Murray.—Limestone was quarried and crushed at the Rayford and Big Canyon quarries of Dolese Bros. Co.; elsewhere, by another producer. Building and paving sand and gravel were produced by Joe Brown Co. Two fields produced petroleum and natural gas.

Muskogee.—Petroleum and a small quantity of natural gas were produced. Mid-Continent Pipe Line Co. completed a 4-inch crude oil gathering system from its Bald Hill station into the reactivated Muskogee field. Sand for structural uses, paving, and fill was dredged from the Arkansas River by Yahola Sand Co. Fansteel Metallurgical Corp. operated its columbium-tantalum plant at Muskogee. Callery Chemical Co. discontinued production of high-energy fuels at its Muskogee plant in January and placed it on a standby status.

Noble.—Petroleum and natural gas were produced from numerous fields. Natural gas liquids were recovered at the Lucien unit plant of Gasoline Plant Management Co. and at the Wunderlich Development Co. Billings plant. Limestone was quarried and crushed for concrete aggregate and roadstone.

Nowata.—Petroleum and natural gas were produced from six fields. Crushed limestone was produced by Peerless Rock Co. Coal production ceased.

Okfuskee.—Petroleum and natural gas were produced from numerous fields. Production from the Olympic field declined to 650,000 bar-

rels of oil. Natural gas liquids were recovered at the Weleetka plant of Grimes & Grimes and at the Laffoon plant of Kerr-McGee Oil Industries, Inc.

Oklahoma.—Petroleum and natural gas were produced from numerous fields. Oklahoma City field yielded over 2.3 million barrels of oil. Natural gas liquids were recovered by Patton & Swab, Inc., Champlin Oil & Refining Co., Phillips Petroleum Co. (two plants), and Cities Service Oil Co. Trumbull Asphalt Co. produced asphalt at its Oklahoma City plant, acquired in 1961 from Monarch Refineries, Inc. Building and paving sand was produced by three operators. Clay for manufacturing brick and tile was obtained from pits in the western part of Oklahoma City by Acme Brick Co. and United Brick & Tile Co. Near Choctaw, clay for lightweight aggregate was mined and expanded by Chandler Materials Co. at its Haydite lightweight aggregate plant, acquired from Texas Industries, Inc., late in the year.

Okmulgee.—Petroleum and natural gas were produced from numerous fields. The Phillips Petroleum Co. refinery at Okmulgee continued to operate. Coal was mined underground near Henryetta by Consolidated Coal Co. Ball Brothers Co. began a $1.5 million expansion of its Okmulgee glass plant. After 43 years of continuous operation, Southwestern Sheet Glass Co. closed its glass plant.

Osage.—The county, with many fields yielding oil and gas, was the State's leading oil producer. The Burbank field produced 14.3 million barrels of oil under an extensive waterflooding program and remained one of the most prolific fields. Natural gas liquids were recovered by Phillips Petroleum Co. at two plants. Limestone was quarried and crushed by Standard Industries, Inc., Sedan Limestone Co., and Murray Limestone Products Corp. for concrete aggregate and roadstone.

Ottawa.—Oklahoma lead and zinc and a major part of the Tri-State District output was supplied from mines in Ottawa County. The increased production was credited to the lead-zinc stabilization program which went into effect in 1961 to encourage production by smaller operators. At Quapaw, the Rare Metals plant of The Eagle-Picher Co. operated during the year. Chat, a product of zinc and lead milling, was supplied by five producers. Tripoli was quarried in east-central Ottawa County by the American Tripoli Division of The Carborundum Co. and processed in its plant at Seneca, Mo.

Pawnee.—Petroleum and natural gas were produced from numerous fields. The Frame Natural Gasoline Co. plant near Cleveland shut down at yearend after 50 years of continuous operation. Limestone was quarried and crushed by Standard Industries, Inc. Construction and paving sand was produced by three operators.

Payne.—Numerous fields produced petroleum and natural gas. Yale-Quay, with a production of nearly 800,000 barrels of oil, was the largest field in the county. Hydrocarbons Development Corp. recovered natural gas liquids at its Norfolk field plant, formerly operated by Gas Products Corp. The Cushing refinery of Midland Cooperatives, Inc., operated throughout the year. The Kerr-McGee Oil Industries, Inc., Cushing refinery stopped manufacturing gas and fuel oil and produced only high-quality lubricating oils because of economic factors. Crushed limestone was produced for concrete aggregate and roadstone by Standard Industries, Inc., at its Cushing quarry.

Pittsburg.—The county moved to second place in production value of coal after the reopening of the Lone Star Steel Co. underground mine near Hartshorne and subsequent increased output. New equipment, employed successfully in several British coal mines, was installed in the mine for more efficient operation. Sandstone was quarried for the U.S. Army Corps of Engineers, Tulsa District, for use as riprap and roadstone on the Eufaula dam construction project. Clay for manufacturing brick and tile was produced by the Oklahoma State Penitentiary west of McAlester. Natural gas was produced from three fields near Quinton.

Pontotoc.—The Ada plant of Ideal Cement Co. operated throughout the year. Clay, shale, and limestone were quarried near Lawrence by Ideal Cement Co. for use in the plant. Dimension and crushed limestone was quarried near Fittstown by Townsend Quarry. Superior Clay Products, Inc., produced clay for manufacturing building brick. Mid-Continent Glass Sand Co. produced glass and molding sands. Building and paving sand was produced by The Dolese Co. Petroleum and natural gas were produced from many fields. Natural gas liquids were recovered at the Fitts field gasoline plant of Humble Oil & Refining Co.

Pottawatomie.—Petroleum and natural gas were produced from numerous fields, of which St. Louis was the largest. Natural gas liquids were extracted from natural gas at the St. Louis plant of Sinclair Oil & Gas Co.

Rogers.—Petroleum and natural gas were produced from three fields; Chelsea district produced most of the crude oil. Quantity of coal, strip mined by Sinclair Coal Co., placed the county third among the Oklahoma coal-producing counties. Dewey Portland Cement Division, Martin Marietta Corp., quarried limestone and shale for use in manufacturing cement at its plant northeast of Tulsa. Limestone was quarried for use as riprap at the Oologah Dam. Shale was mined by Chandler Materials Co. as raw material for its lightweight aggregate plant. The U.S. Army Corps of Engineers, Tulsa District, continued work on the Oologah Dam on the Verdigris River. At year-end, the dam was virtually completed.

Seminole.—Petroleum and natural gas were produced from many fields, of which Seminole City field was the most prolific. Natural gas liquids were recovered at plants of Redco Corp., Sinclair Oil & Gas Co., and Phillips Petroleum Co. Limestone was quarried and crushed for concrete aggregate and roadstone. Clay for brick and tile was obtained west of Wewoka by Wewoka Brick and Tile Co.

Sequoyah.—Limestone was mined and crushed north of Marble City at the St. Clair Lime Co. quarry. Part of the limestone was burned in the company kilns at Sallisaw, the remainder was used for soil conditioning and highway construction and maintenance. The total value of coal mined from open pits by Sallisaw Stripping Co. was the sixth highest in the State. Natural gas was produced from a small field.

Stephens.—The county ranked third in value of total mineral output, second in petroleum production, and fourth in natural gas output, although the total value was 12 percent below that of 1961. Natural gas liquids were recovered by Mobil Oil Co., Service Gas Products

Co., Skelly Oil Co., and Warren Petroleum Corp. Sunray DX Oil Co. operated its refinery at Duncan throughout the year.

Texas.—The county ranked first in value of natural gas produced from the vast Hugoton gasfield and seventh in total mineral value. Natural gas liquids were recovered near Guymon by Cities Service Oil Co. and Hugoton Plains Gas & Oil Co. and at other locations by Dorchester Corp., Excelsior Corp., Mobil Oil Co., and Anadarko Products Co., Panhandle Eastern Pipeline Co. subsidiary. Building and paving sand and gravel were produced by one operator.

Tulsa.—In west Tulsa, The Texas Co. and Sunray DX Oil Co. refineries operated throughout the year. Sunray DX Oil Co. began constructing the final phase of a new water-treating system. Waste water from the processing units would first pass through a primary clarifier which would remove most of the oil from the water. It would then be pumped to air flotation tanks where chemicals and compressed air would remove the last traces of oil. Near Garnett, crushed limestone was produced by Anchor Stone and Material Co., Chandler Materials Co., and Standard Industries, Inc. (two quarries). Construction and paving sand were produced by nine operators. In Tulsa, brick and tile were manufactured by Acme Brick Co. and United Brick & Tile Co., and in Collinsville, by United Brick & Tile Co. The U.S. Army Corps of Engineers, Tulsa District, continued work on the Keystone Dam on the Arkansas River. The last concrete was poured on the spillway in September.

Washington.—Total mineral value declined 30 percent because of production losses in petroleum, stone, clay, and cement. Petroleum and natural gas were produced in five districts. Dewey Portland Cement Co. quarried limestone and clay near Dewey for manufacturing portland cement. The plant resumed full production early in January after closing in October 1961. In April the company announced a partial cutback in operation. Crushed limestone was produced east of Bartlesville by M. E. Stewart and Sons. The Bartlesville smelter of National Zinc Co. was shut down on June 1 by a 2-month strike of the Oil, Chemical, and Atomic Workers Union. Sulfuric acid, a byproduct from imported zinc ores, was produced at the smelter in addition to zinc.

Washita.—Natural gas and petroleum were produced from several small fields and from part of the prolific Elk City field. Gypsum for soil conditioning was quarried near Colony by Agricultural Gypsum Co.

Woods.—Natural gas and petroleum were produced from several small fields. Ezra Blackmon recovered salt by solar evaporation from water basins adjacent to the Cimarron River west of Freedom. Paving sand was produced near Waynoka by Waynoka Sand & Gravel Co.

The Mineral Industry of Oregon

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Oregon Department of Geology and Mineral Industries for collecting information on all minerals except fuels.

By Frank B. Fulkerson,[1] William N. Hale,[2] and Robert A. Miller [2]

MINERAL production in Oregon totaled $52.5 million, a decline of $634,000 from that of 1961. Stone, sand and gravel, cement, and nickel ore were the principal mineral commodities. The value of stone production decreased slightly owing to a lower average value per ton of crushed stone and fill material produced for U.S. Army Corps of Engineers projects. Cement production in the State declined in quantity and value. In contrast, output of sand and gravel rose in value to $14.6 million, compared with $13.7 million in 1961; this resulted from an increased production of sand and gravel by commercial producers. Output of nickel ore was about the same as in 1961.

Besides stone, sand and gravel, and cement, nonmetal production included mostly clays, lime, and pumice and volcanic cinder. In addition to nickel ore, metal output comprised small quantities of gold, silver, copper, mercury, iron ore, and uranium.

Reynolds Metals Co. curtailed aluminum production at its Troutdale plant owing to excess inventories of primary metal. The plant was producing at only 25 percent of capacity at yearend. Prospects for expansion of the aluminum industry in the State were dimmed when Cerro Corp. cancelled plans to build an aluminum reduction plant at Wauna. Competition from imported products affected output at Oregon Steel Mills, Inc., Portland.

Exploration for oil and gas in the State and offshore continued. Individually or jointly, at least 10 major companies conducted seismic, gravity, and magnetic surveys along the coastal areas. Inland, the search for oil was concentrated in the Willamette Valley.

Consumption, Trade, and Markets.—The mineral industries benefited from increased Oregon business activity. Total personal income was

[1] Economist, Bureau of Mines, Albany, Oreg.
[2] Geologist, Bureau of Mines, Albany, Oreg.

TABLE 1.—Mineral production in Oregon [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays—thousand short tons	294	$357	249	$305
Diatomite—short tons	(2)	(2)	50	2
Gold (recoverable content of ores, etc.)—troy ounces	1,054	37	822	29
Iron ore (usable)—long tons	829	(2)	(2)	(2)
Lime—thousand short tons	82	1,702	78	1,514
Mercury—76-pound flasks	138	27	(2)	(2)
Nickel (content of ore and concentrate)—short tons	12,860	(2)	13,110	(2)
Perlite—do			3	(2)
Pumice and volcanic cinder—thousand short tons	203	461	(2)	(2)
Sand and gravel—do	12,299	13,680	14,869	14,556
Silver (recoverable content of ores, etc.)—troy ounces	2,022	2	6,047	7
Stone—thousand short tons	[4] 17,455	[4] 21,202	18,258	20,977
Uranium ore—short tons	2,160	66	2,722	112
Zinc (recoverable content of ores, etc.)—do	3	1		
Value of items that cannot be disclosed: Asbestos, cement, copper, gem stones, lead and values indicated by footnote 2		15,557		14,956
Total		[4] 53,092		52,458

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Less than $500.
[4] Revised figure.

TABLE 2.—Indicators of Oregon business activity

	1961	1962 [1]	Change, percent
Personal income:			
Total—millions	$4,089.0	$4,323.0	+5.7
Per capita	$2,273.0	$2,319.0	+2.0
Construction activity:			
Building permits—millions	$184.7	$227.1	+23.0
Heavy engineering awards—do	$106.8	$131.3	+22.9
Value of highway contracts awarded—do	$54.3	$76.6	+41.1
Expenditures on highway contract work—do	$49.0	$58.3	+19.0
Cement shipments to and within Oregon—thousand 376-pound barrels	2,954.4	3,045.2	+3.1
Cash receipts from farm marketings—millions	$392.9	$430.2	+9.5
Factory payrolls—do	$763.2	$807.0	+5.7
Annual average labor force and employment:			
Total labor force—thousands	725.1	728.7	+.5
Unemployment—do	45.3	38.1	−15.9
Employment:			
Construction—do	24.5	26.2	+6.9
Lumber and wood products—do	67.1	67.2	+.1
Food products—do	20.8	20.9	+.5
All manufacturing—do	139.1	141.4	+1.7
All industries—do	679.3	690.0	+1.6

[1] Preliminary figures.

Sources: Survey of Current Business, Construction Review, Pacific Builder & Engineer, State Highway Commission, Oregon Business Review, Grow With Oregon, Oregon's Labor Market, Oregon Covered Employment and Payrolls, and Bureau of Mines.

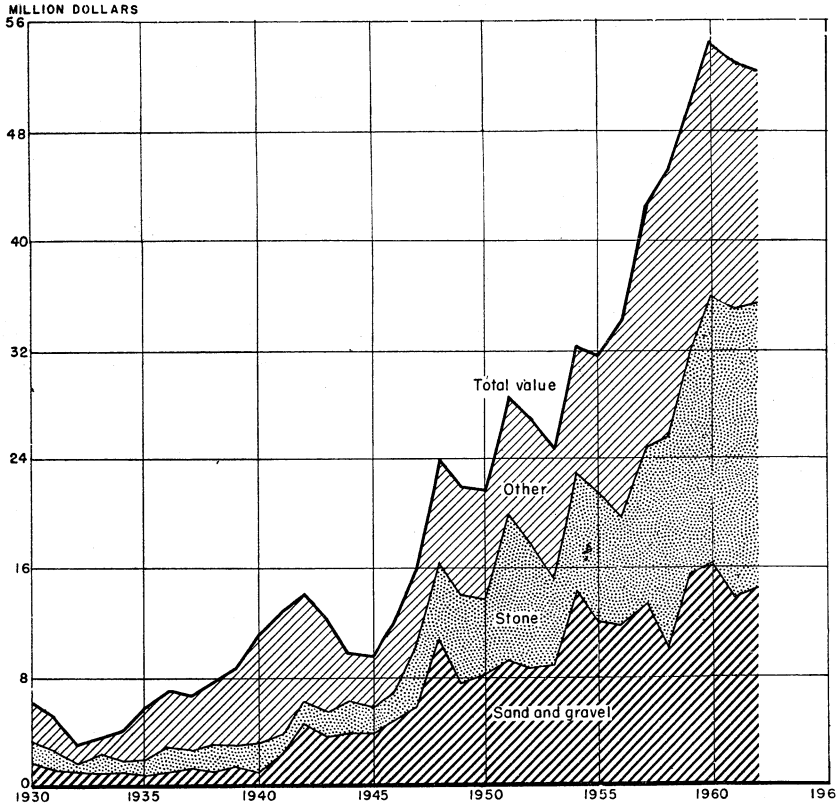

FIGURE 1.—Value of sand and gravel and stone, and total value of mineral production in Oregon, 1930–62.

TABLE 3.—Employment and payrolls in mineral-industry establishments subject to Oregon unemployment-compensation law, by industries

Industry	1961		1962	
	Employment	Payrolls (thousands)	Employment	Payrolls (thousands)
Mining	1,112	$6,558	1,263	$7,272
Stone, clay, and glass products:				
Glass and pottery	307	1,933	370	2,254
Hydraulic cement	425	2,724	401	2,760
Structural clay products	188	985	146	731
Concrete, gypsum, and plaster products	1,614	9,743	1,785	11,169
Cut-stone and stone products	44	251	38	225
Miscellaneous	96	580	80	450
Total	2,674	16,216	2,820	17,589
Primary metals:				
Blast furnaces, steelworks, rolling and finishing mills	1,390	10,225	1,260	9,343
Primary smelting and refining of nonferrous metals	1,802	11,957	1,757	12,036
Iron and steel foundries	1,826	11,535	1,878	12,075
Nonferrous foundries	311	1,730	338	1,961
Secondary smelting and refining of nonferrous metals and miscellaneous industries	203	1,215	172	1,106
Total	5,532	36,662	5,405	36,521
Industrial chemicals	485	3,274	427	2,963
Petroleum refining and related products	336	2,000	352	2,190
Grand total	10,139	64,710	10,267	66,535

Source: Oregon Employment Department. Industries may vary from those in the Bureau of Mines canvass.

TABLE 4.—Employment and injuries in the mineral industries

Year and industry	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:						
Quarries and mills [1 2]	739	227	1,339,649	----------	57	43
Nonmetal mines and mills	178	174	247,620	----------	9	36
Sand and gravel operations [2]	768	204	1,254,223	1	26	22
Metal mines and mills	182	183	267,076	1	18	71
Coal mines	8	34	2,159	----------	1	463
Total	1,875	207	3,110,727	2	111	36
1962: [3]						
Quarries and mills [1 2]	865	205	1,420,618	2	48	35
Nonmetal mines and mills	171	163	222,691	----------	9	40
Sand and gravel operations [2]	824	187	1,231,818	----------	27	22
Metal mines and mills	173	136	188,726	----------	4	21
Coal mines	6	43	2,736	----------	----------	----------
Total	2,039	188	3,066,589	2	88	29

[1] Includes cement- and lime-processing plants.
[2] Includes only commercial operations.
[3] Preliminary figures.

up 6 percent, and per capita personal income increased 2 percent. Factory payrolls advanced $44 million. Unemployment was down by 16 percent. Manufacturing employment gained 2 percent, even though the average number of workers was unchanged in lumber and wood products, the main manufacturing industry. In the construction industry all indicators increased, including building permits, heavy engineering awards, highway building expenditures,

cement shipments to and within the State, and construction employment.

Employment and Injuries.—According to the Oregon Employment Department, the number of workers in the mineral industries (mining; stone, clays, and glass products; primary metals; industrial chemicals; and petroleum refining and related industries) averaged 10,267, compared with 10,139 in 1961. Mining-industry employment rose to 1,263, compared with 1,112 in 1961.

Table 4 provides mineral-industry injury data, compiled by the Bureau of Mines from reports by the companies.

Government Programs.—Two active contracts under the program of the Office of Minerals Exploration, U.S. Department of the Interior, covered exploration projects by Emerald Empire Mining Co. (lead, zinc, and copper) in Lane County and Pacific Minerals & Chemical Co., Inc. (mercury), in Crook County. The contracts were for $62,800 and $69,720, respectively, with Government participation of 50 percent.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Asbestos.—A small quantity of chrysotile asbestos was produced by Coast Asbestos Co. at an experimental operation north of Mount Vernon in Grant County. Output was shipped to California for further processing and marketing.

Cement.—A strike in the construction industry during June and July resulted in reduced cement sales; production and shipments of cement declined 6 and 8 percent, respectively, compared with those of 1961. As in previous years, output was from plants of Oregon Portland Cement Co. at Oswego (Clackamas County) and Lime (Baker County) and Ideal Cement Co. at Gold Hill (Jackson County).

Destinations were chiefly within the State; out-of-State shipments were made to Washington, Idaho, northern California, and Alaska. Trucking was the principal method of transportation; 90 percent of the material was transported by truck, 9 percent by rail, and 1 percent by boat. The ratio of bulk to paper bag shipments was about 5 : 1.

Nine cement plants in Oregon and Washington produced 7,190,325 barrels (376 pounds each) of finished portland cement; shipments from the same plants totaled 7,080,589 barrels. The average value of portland cement shipped from producing plants was $3.56 per barrel, f.o.b. plant, compared with $3.53 in 1961.

Clays.—The quantity of clays sold or used by producers declined 15 percent from that of 1961. This was because less clay was produced for use in making heavy clay products (mainly building brick and draintile), less clay and shale were consumed in making cement, and the production of expanded shale was lower.

Crude material for use in heavy clay products was produced in Benton, Clackamas, Klamath, Marion, Multnomah, Polk, Tillamook, Union, Washington, and Yamhill Counties. Clay and shale used at cement plants were produced in Baker and Jackson Counties.

Keasey shale was expanded at the Smithwick Concrete Products Co. and the Northwest Aggregate, Inc., plants in Washington County.

Bloated material was marketed mainly for use in lightweight concrete aggregate and as pozzolan for concrete used in constructing the John Day Dam.

Central Oregon Bentonite Co. continued to produce bentonite at the Silver Wells operation southeast of Prineville; output declined 46 percent from that of 1961. The material was marketed for use as a binder in making stock-feed pellets, as a sealer for irrigation canals, as a forest fire retardant, as a filler in insecticides, and for use in oil-well drilling muds.

Diatomite.—A. M. Matlock continued to develop a diatomite deposit east of Silver Lake in northern Lake County. Crude diatomaceous earth was ground and screened to pebble size and sold for pet litter by Pacific Diatomite Corp. of Eugene.

Lime.—Three companies produced 75,293 tons of quicklime and 2,387 tons of hydrated lime valued at $1.5 million. The aluminum, calcium carbide, pulp and paper, and steel industries consumed 33,980 tons of quicklime produced by Chemical Lime Co., Baker. Hydrated lime output, totaling 2,387 tons, was sold for use in paper manufacturing and water purification. Lime was shipped out of State to Idaho, Montana, Washington, and Alaska.

Pacific Carbide & Alloys Co. imported limestone from Canada to supply its limekilns at Portland. Quicklime production, totaling 12,858 tons, was utilized by the firm to manufacture calcium carbide.

The Amalgamated Sugar Co., Nyssa, made 28,445 tons of quicklime for use in sugar refining.

Four pulp mills processed calcium carbonate sludge to lime for use in paper manufacturing.

Late in 1962, Ash Grove Lime & Portland Cement Co., Kansas City, Mo., purchased a 30-acre tract of land in the Portland Rivergate industrial district at the confluence of the Willamette and Columbia Rivers and announced plans to construct a $3.5 million, 250-ton-per-day lime plant on the site. Tentative plans were to barge limestone to the plant from Texada Island, British Columbia.

Perlite.—Supreme Perlite Co., Portland, expanded crude perlite shipped from Nevada by Combined Metals Reduction Co. The expanded product was marketed chiefly as a building plaster aggregate; smaller quantities were sold for soil conditioning and for concrete aggregate use.

A. M. Matlock continued developing the Eagles Nest perlite deposit near Paisley. A small amount of screened perlite was shipped to Supreme Perlite Co. for experimental purposes.

Pumice and Volcanic Cinder.—Central Oregon Pumice Co. and Boise Cascade Pumice produced pumice and volcanic cinder at quarries near Bend. Processed material was sold to leading concrete-products plants throughout the Northwest, California, and Canada. Small quantities of pumice were utilized for insulation purposes.

Numerous volcanic cinder deposits yielded material for county and State road construction.

Sand and Gravel.—Total output of sand and gravel was 14.9 million tons valued at $14.6 million—an increase of 21 and 6 percent, respectively, over the 1961 tonnage and value.

About 4 million tons of the sand and gravel output was pit-run (unprocessed), mainly from operations in Linn and Lane Counties, for use at U.S. Army Corps of Engineers dam-building projects. Sand and gravel output by commercial producers was 9.6 million tons, compared with 6.5 million tons in 1961. Government-and-contractor production was 5.2 million tons, compared with 5.8 million tons in 1961. Production was reported from 34 of the 36 counties. Output exceeding 3 million tons was reported from Lane County; over 2 million tons was mined in Multnomah County; and over 1 million tons each was mined in Douglas, Gilliam, and Jackson Counties.

Sand and gravel deposits in the Willamette Valley were the subject of a report.[3]

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Building	2,634	$3,183	2,839	$3,402
Road material	3,116	3,816	4,997	5,833
Other [1]	727	584	1,793	1,143
Total	6,477	7,583	9,629	10,379
Government-and-contractor operations:				
Building	126	106	153	166
Road material	5,695	5,990	4,992	3,954
Other [1]	(2)	(3)	95	58
Total	5,822	6,097	5,240	4,178
All operations:				
Building	2,760	3,289	2,992	3,569
Road material	8,811	9,806	9,989	9,786
Other [1]	727	584	1,888	1,201
Grand total [4]	12,299	13,680	14,869	14,556

[1] Includes fill material, special sands, railroad ballast, and sand and gravel used for miscellaneous purposes.
[2] Less than 500 short tons.
[3] Less than $500.
[4] Owing to rounding, individual items may not add to totals shown.

Stone.—Output of stone reached a record 18.3 million tons valued at $21 million, compared with 17.5 million tons valued at $21.2 million in 1961. The rise in output resulted from increased quantities of crushed stone used at U.S. Army Corps of Engineers dam-building projects. Stone output by commercial concerns was 3.4 million tons, and Government-and-contractor production was 14.9 million tons, compared with 3.9 and 13.6 million tons, respectively, in 1961.

Basalt continued to be the principal stone quarried. It was used for roadstone, ballast, and riprap.

The quantity of limestone quarried was 900,740 tons, compared with 952,000 tons in 1961. Reduced demand for limestone in cement

[3] Glenn, J. L. Gravel Deposits in the Willamette Valley Between Salem and Oregon City, Oregon. Oregon Dept. Geol. and Miner. Ind., The Ore-Bin, v. 24, No. 3, March 1962, pp. 34–47.

manufacture and the use of limestone imported from Canada accounted for the decrease. The largest tonnage was consumed by the cement industry, followed by the sugar, lime, paper, metallurgical, and agricultural industries. Imported limestone from Canada was used in making calcium carbide and cement. Limestone for industrial use was quarried in Baker, Josephine, Polk, and Wallowa Counties.

Industrial silica (quartz) was produced by Bristol Silica Co. from a quarry near Gold Hill, Jackson County. Crushed silica was marketed for manufacturing silocon carbide, ferrosilicon, silica refractories and abrasives, and for other industrial purposes. Bristol Silica also developed markets for white quartz to be used as decorative stone. M & B Logging Co. shipped siliceous material from the Quartz Mountain deposit (Big Quartz mine) to Hanna Nickel Smelting Co. at Riddle for test purposes. Silica deposits of the Pacific Northwest were the subject of a report.[4]

Dimension stone was quarried in Baker, Jefferson, Lake, Marion, Multnomah, Wasco, and Wallowa Counties. The various volcanic tuffs available in many parts of the State were the basis for most of the dimension stone produced.

Stone was produced from operations in all 36 counties. Output exceeded 7 million tons in Lane County.

TABLE 6.—Stone sold or used by producers, by uses

(Thousand short tons and thousand dollars)

Use	1961		1962	
	Quantity	Value	Quantity	Value
Building (dimension stone)	3	$29	2	$20
Concrete and roadstone	[1] 11,183	[1] 14,232	9,403	12,246
Railroad ballast	[2]	[2]	[2]	[2]
Riprap	4,717	4,910	7,737	6,998
Other [3]	1,552	2,030	1,116	1,714
Total [4]	[1] 17,455	[1] 21,202	18,258	20,977

[1] Revised figure.
[2] Included with "Other" to avoid disclosing individual company confidential data.
[3] Used at cement, paper, metallurgical, and chemical plants; at sugar refineries; and for miscellaneous unspecified purposes.
[4] Owing to rounding, individual items may not add to totals shown.

Talc and Soapstone.—Soapstone mined in northwestern Washington was ground at Portland plants of Stauffer Chemical Co. and Miller Products Co. Prepared soapstone was marketed for use as an inert carrier in insecticides.

Vermiculite (Exfoliated).—Production and shipments of exfoliated vermiculite were moderately higher than in 1961. Vermiculite Northwest, Inc., Portland, utilized crude vermiculite shipped from Montana, and Supreme Perlite Co., Portland, exfoliated crude material imported from South Africa. The finished product was marketed as loose-fill insulation, as a lightweight aggregate for plaster and concrete, and as a soil conditioner.

[4] Carter, George J., Hal J. Kelly, and E. W. Parsons. Industrial Silica Deposits of the Pacific Northwest. BuMines Inf. Circ. 8112, 1962, 57 pp.

METALS

Aluminum.—Cerro Corp. dropped its option on 1,030 acres of Columbia River front land at Wauna and terminated an agreement with the Bonneville Power Administration to furnish electrical power.

Reynolds Metals Co., Troutdale, reduced its normal employment (700) by 68 on October 31 and by 319 on November 30. The plant was to operate at 25 percent of capacity, compared with 62 to 75 percent of capacity during the previous 2 years.

Alumina, to be produced by Harvey Aluminum, Inc., at a plant under construction in the Virgin Islands, was to be reduced at The Dalles; the aluminum was then to be shipped to various captive fabrication mills.

The Pacific Northwest aluminum industry was the subject of a report.[5]

Chromium.—No chromium ore or concentrate was produced in 1962. Results of an investigation of chromium resources in southwestern Oregon were published.[6]

Copper.—Copper output increased slightly over that of 1961 but still remained low. Golden Road Mining Co. shipped over 80 percent of the State production from operations in the Pleasant Valley (Evans Creek) district, Jackson County. Copper as a byproduct of gold operations came from mines in Grant, Jefferson, and Lane Counties.

Ferroalloys.—Union Carbide Metals Co., Portland, produced calcium carbide, ferromanganese, silicomanganese, and ferrosilicon. Manganese ore was imported through the Port of Portland, and silica was obtained from mines in Washington and Oregon.

National Metallurgical Co., Springfield, a producer of silicon metal, was included in a sale of the parent company, Apex Smelting Co., to American Metal Climax, Inc.

A report was published covering the ferroalloy industry of the Pacific Northwest.[7]

Gold.—Oregon gold output decreased 232 ounces from that of 1961 to the second lowest total in the history of the State. Production was divided equally between 21 placer operations and 14 lode producers.

Deposits in the Greenback district, Josephine County, accounted for nearly one-third of the total production, owing to placer operations at the Davis and Joe Joe mines. Over 67 percent of the lode output was mined in Baker and Grant Counties; the Buffalo mine, Grant County, was the leading producer.

Iron Ore.—Magnetite-hematite ore was shipped from the Hanby iron property, Sparta district, Baker County.

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[5] Fulkerson, Frank B. Trends and Outlook in the Pacific Northwest Aluminum Industry. BuMines Inf. Circ. 8046, 1962, 42 pp.

[6] Ramp, Len. Chromite in Southwestern Oregon. Oregon Dept. Geol. and Miners Ind. Bull. 52, 1961, 169 pp.

[7] Kingston, Gary A. The Pacific Northwest Ferroalloy Industry. BuMines Inf. Circ. 8050, 1962, 26 pp.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals[1]

Year	Mines producing		Material sold or treated[2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
1953-57 (average)	17	20	2,510	4,567	$160	12,975	$12
1958	17	33	1,947	1,423	50	2,728	2
1959	10	27	356	686	24	242	(3)
1960	13	34	1,231	835	29	284	(3)
1961	15	27	782	1,054	37	2,022	2
1962	14	21	2,117	822	29	6,047	7
1852-1962			(4)	5,793,800	130,736	5,381,047	4,937

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953-57 (average)	10	$6	5	$1			$179
1958	10	5	1	(3)			58
1959							24
1960	6	4					33
1961	(5)	(5)	(5)	(5)	3	$1	44
1962	(5)	(5)	(5)	(5)			43
1852-1962	12,492	4,720	830	100	176	24	140,517

[1] Includes recoverable metal content of gravel washed (placer operations), old tailings retreated, ore milled, and ore shipped to smelters during calendar year indicated. Owing to rounding, individual items may not add to totals shown.
[2] Does not include gravel washed.
[3] Less than $500.
[4] Data not available.
[5] Figure withheld to avoid disclosing individual company confidential data.

TABLE 8.—Gold production at placer mines

Year	Mechanical and hydraulic methods			Small-scale hand methods[1]			Total		
	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)
1953-57 (average)	12	761	2,526	8	8	78	20	769	2,604
1958	24	258	489	9	6	56	33	264	545
1959	19	54	396	8	4	54	27	58	450
1960	14	226	610	20	5	58	34	231	668
1961	10	[2] 104	570	17	17	135	27	121	705
1962	[3] 7	94	342	14	14	69	21	108	411

[1] Includes surface and underground (drift) placers.
[2] Does not include material washed at commercial gravel plants to produce byproduct gold and silver.
[3] Includes 2 dragline dredges, 4 hydraulic operations, and 1 nonfloating washing plant.

Lead.—Lead contained in gold and silver ores accounted for all of the output. The Champion mine, Bohemia district, Lane County, yielded over half of the total; the remainder came from the Buffalo mine, Granite district, Grant County, and the Oregon King mine, Ashwood district, Jefferson County.

Mercury.—Output was the lowest recorded since 1950. The only mercury production was from the Angel Peak mine, Lake County.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines	Material sold or treated (thousand short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold, gold-silver, dry silver, copper, and gold cleanings [1]	14	2,117	411	5,989	(2)	(2)	----------
Total lode	14	2,117	411	5,989	(2)	(2)	----------
Placer	21	(3)	411	58	----------	----------	----------
Grand total	35	2,117	822	6,047	(2)	(2)	----------

[1] Combined to avoid disclosing individual company confidential data.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] 108,350 cubic yards of placer gravel washed.

An agreement was signed between the Office of Minerals Exploration and Pacific Minerals & Chemical Co., Inc., Olympia, Wash., to explore for mercury ore in deposits in the Ochoco mining district, Crook County. The Government share in the project was to be $34,860.

Nickel.—Hanna Mining Co. mined 874,000 tons of nickel silicate ore, averaging 1.5 percent nickel, from its Douglas County multiple-bench operation near Riddle. Hanna Nickel Smelting Co. produced 39,820,634 pounds of ferronickel containing 21,138,893 pounds of nickel.

Silver.—Output of silver was the highest since 1957. Lode deposits yielded the larger part of the total. Two operations—the Buffalo mine, Grant County, and the Oregon King mine, Jefferson County—supplied most of the production.

The Oregon King mine was the subject of a report.[8]

Steel.—Oregon Steel Mills, Inc., Portland, the only producer of rolled-steel products in the State, reduced prices in October on Merchant-quality bars, bar-size shapes, and standard structural shapes. The firm operated at 40 percent of rated capacity at the end of 1962.

The steel industry of the Pacific Northwest was reported.[9]

Uranium ore.—Two Lake County mines produced uranium ore. At the Lucky Lass mine ore horizons were intersected as overburden was stripped to reach ore zones drilled previously; 1962 production came from these ore horizons. Mining at the White King mine, leased by Thornburg Mining Co., was from high-grade pockets and zones of ore in the bottom of the pit. Output was shipped to the Vitro Chemical Co. mill at Salt Lake City, Utah.

Zinc.—No production of zinc was recorded during 1962.

Other Metals.—Wah Chang Corp., Albany, Linn County, developed a self-cooling rocket nozzle by infiltrating porous tungsten with silver. In actual application, the silver vaporizes and cools the surrounding tungsten metal. The tungsten-sintering capacity of the plant was increased. To its list of refractory metals was added the production

[8] Libbey, F. W., and R. E. Corcoran. The Oregon King Mine, Jefferson County, Oregon. Oregon Dept. Geol. and Miner. Ind., Short Paper 23, 1962, 49 pp.
[9] Kingston, Gary A., and Frank B. Fulkerson. The Pacific Northwest Steel Industry. BuMines Inf. Circ. 8073, 1962, 45 pp.

of molybdenum sheet, prepared from molybdenum oxide by a hydrogen-reduction process.

Oregon Metallurgical Corp., Albany, received new orders for high-purity vanadium and for zirconium ingots. The Albany corporation had produced to date over 25,000 pounds of high-purity vanadium. A horizontal, centrifugal-casting process was used for producing thick- or thin-walled rings or pipe from refractory metals. The casting process eliminated a welded seam if the ring or pipe was rolled-formed or coarse grain in the outer edges if it was machined.

Northwest Industries, Inc., formerly Oregon Precision Industries, Inc., began constructing a 13,000-square-foot addition to its Albany plant. The facility was to be equipped to perform refractory metal fabrications for the chemical, missile, electronic, metallurgical, and related industries.

MINERAL FUELS

Coal.—Pacific Power & Light Co. obtained two leases, covering about 5,000 acres, on the Eden Ridge coal deposits in Coos County. Pacific Power had been evaluating the Eden Ridge area coal resources during the previous 4 years to determine if adequate reserves of suitable coal were available to supply a proposed 100,000-kilowatt generating plant.

Natural Gas.—Southern Pacific Pipe Lines, Inc., constructed a 113-mile petroleum pipeline between Portland and Eugene. A tank farm near Eugene, consisting of 28 tanks and an underground reservoir, served as the southern terminal and storage area for the pipeline.

El Paso Natural Gas Co. applied to the Federal Power Commission (FPC) for authority to build a 127-mile natural gas pipeline from Eugene to Grants Pass at a cost of $7.6 million. California Pacific Utilities Co. planned to build 63 miles of line from Grants Pass to Ashland. Existing distribution systems in 7 cities were to be converted to natural gas, and new distribution systems were planned in 10 cities. Start of construction depended upon FPC approval.

Petroleum.[10]—The Oregon Department of Geology and Mineral Industries issued six drilling permits for oil and gas tests during 1962. Footage drilled totaled 23,335 feet.

Exploration for oil and gas in the State and offshore continued. Individually, or jointly, at least 10 major companies conducted seismic, gravity, and magnetic surveys along the coastal areas of the State. Increased exploration activity in the coastal areas resulted from the passage of the Oregon Submerged Land Acts of 1961. No leases had been issued on offshore lands since 1961; however, there was one application for an offshore lease in 1962.

Federal preliminary lease maps were compiled for Oregon offshore areas. The area covered in the offshore Federal parceling system extends an average of 40 miles seaward from the Oregon coastline. Water depth ranges from 180 feet at the State boundary to 3,000 feet at the edge of the shelf lands.

Oregon coastal areas were the subject of a report.[11]

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[10] Oil-well drilling data were obtained from The Ore–Bin, a monthly publication of the Oregon Department of Geology and Mineral Industries.

[11] Byrne, John V. Geomorphology of the Continental Terrace Off the Central Coast of Oregon. Oregon Dept. Geol. and Miner. Ind., The Ore–Bin, v. 24, No. 5, May 1962, pp. 65–74.

Inland, the search for oil was concentrated in the Willamette Valley. Major firms, including Humble Oil & Refining Co., Superior Oil Co., and Gulf Oil Corp., continued to lease land in the Willamette Valley. In May, an estimated total of 1 million acres was under lease in the valley by various companies.

Interpretative results of two aeromagnetic surveys were published.[12]

A report of petroleum exploration in Oregon was published.[13]

REVIEW BY COUNTIES

Mineral production was reported from all 36 counties in 1962. With certain important exceptions, output was principally from nonmetallic deposits. Only selected counties with significant metal and nonmetal developments are discussed in the following review.

Baker.—The Oregon Portland Cement Co. plant at Lime continued, in terms of value, to be the principal mineral industry activity. Limestone for the plant was supplied from the nearby company Limerock quarry, and the cement operation utilized shale from the company-owned Gales Creek quarry. Limestone for industrial and agricultural uses was quarried near Durkee by the cement company.

Chemical Lime Co. produced quicklime and hydrated lime at a plant north of Baker. Limestone for the operation was obtained from the company Marble Creek quarry northwest of Baker. Output of stone declined, owing to less limestone used by the cement and lime industries and less crushed-stone production for use as road material by the State highway department.

Clackamas.—Oregon Portland Cement Co. continued cement production at the Oswego plant but at a slightly lower rate than in 1961. To reduce transportation costs, the company, began barging limestone to the Oswego plant from a quarry on the north end of Texada Island, British Columbia, in August. Pacific Lime Co., a division of Dominion Tar & Chemical Co., Ltd., was to crush the limestone before shipping it to the cement plant. To accommodate the barges at Oswego, docking and unloading facilities were constructed and a 20-foot channel was dredged from the Ross Island Bridge to Oswego. Oregon Portland Cement Co. in the past had shipped limestone by rail from a quarry near Durkee.

Crook.—Bentonitic clay was mined at an operation 64 miles southeast of Prineville in the Camp Creek area by Central Oregon Bentonite Co.

Deschutes.—Two operators, Boise Cascade Pumice and Central Oregon Pumice Co., marketed sized pumice and volcanic cinder from various quarries near Bend. Anderson Mining & Development Co. began constructing a facility to process bentonite at Bend. Bentonitic clay from the Silver Wells operation in the Camp Creek area was to be ground, sized, and bagged at the plant.

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[12] Bromery, R. W. Geologic Interpretation of the Aeromagnetic Map of the Lebanon Quadrangle, Linn and Marion Counties, Oregon. U.S. Geol. Survey Geophys. Inv. Map G.P. 212, 1962.
Bromery, R. W. Preliminary Interpretation of an Aeromagnetic Map of the Albany–Newport Area, Oregon. U.S. Geol. Survey, Oregon Dept. Geol. and Miner. Ind., Open File Report, 1962.

[13] Oregon Department of Geology and Mineral Industries. Petroleum Exploration in Oregon. Misc. Paper 9, 1962, 31 pp.

TABLE 10.—Value of mineral production in Oregon, by counties

(Thousand dollars)

County	1961	1962	Minerals produced in 1962 in order of value
Baker	$4,927	$4,028	Cement, stone, lime, sand and gravel, clays, gold, iron ore, silver.
Benton	251	318	Sand and gravel, stone, clays.
Clackamas	(1)	6,242	Cement, sand and gravel, stone, clays.
Clatsop	84	504	Stone. sand and gravel.
Columbia	[2] 302	219	Do.
Coos	530	613	Stone, sand and gravel, gold, silver.
Crook	[3] 432	101	Sand and gravel, stone, clays.
Curry	405	201	Sand and gravel, stone.
Deschutes	870	528	Pumice, sand and gravel, stone.
Douglas	7,001	7,912	Nickel, stone, sand and gravel, gold, silver.
Gilliam	435	748	Sand and gravel, stone.
Grant	103	134	Sand and gravel, asbestos, gold, silver, stone, copper, lead.
Harney	325	261	Stone, sand and gravel.
Hood River	535	487	Do.
Jackson	4,387	4,423	Cement, sand and gravel, stone, clays, copper, gold, silver.
Jefferson	(1)	192	Stone, sand and gravel, silver, gold, copper, lead.
Josephine	753	470	Sand and gravel, stone, gold, silver.
Klamath	[2] 944	738	Stone, sand and gravel, clays.
Lake	343	235	Uranium, stone, sand and gravel, diatomite, mercury, pumice, perlite.
Lane	[3] 7,791	10,049	Stone, sand and gravel, gold, lead, copper, silver.
Lincoln	[3] 632	460	Stone, sand and gravel.
Linn	[3] 828	1,062	Stone, sand and gravel, gold, silver.
Malheur	735	991	Lime, stone, sand and gravel, gold, silver.
Marion	433	576	Sand and gravel, stone, clays.
Morrow	500	71	Stone, sand and gravel.
Multnomah	3,775	3,194	Sand and gravel, stone, lime, clays.
Polk	(1)	475	Sand and gravel, stone, clays.
Sherman	456	76	Stone.
Tillamook	208	1,053	Stone, sand and gravel, clays.
Umatilla	608	1,286	Stone, sand and gravel.
Union	713	507	Stone, sand and gravel, clays.
Wallowa	188	269	Stone, sand and gravel.
Wasco	236	664	Do.
Washington	1,045	598	Stone, clays, sand and gravel.
Wheeler	107	126	Stone.
Yamhill	135	373	Stone, sand and gravel, clays.
Undistributed [4]	[3] 12,075	2,274	
Total	[3] 53,092	52,458	

[1] Figures withheld to avoid disclosing individual company data; included with "Undistributed."
[2] Revised figure (recycled lime excluded).
[3] Revised figure.
[4] Includes value of mineral production that cannot be assigned to specific counties and values indicated by footnote 1.

Douglas.—The production of commercial ferronickel by Hanna Nickel Smelting Co. decreased from the 1961 and 1960 output, but the average nickel content was raised from 45.6 percent in 1960 and 51 percent in 1961 to 53 percent in 1962. The higher grade product, required by marketing economics, was achieved by adjustments of metallurgical practices.

Hood River.—The Jucho Co., a manufacturing firm at Dortmund, Germany, announced plans to construct a steel fabrication plant at Hood River. The company planned to fabricate all types of steel, including that for building superstructures and transmission towers. The company anticipated that much of its present German production for American buyers would be absorbed by the plant.

Jackson.—Ideal Cement Co. continued production of cement at Gold Hill, output was 39 percent greater than in 1961. Limestone used at the plant was obtained from a quarry in Josephine County, and shale was supplied from the company Gold Hill quarry. Bristol Silica Co. quarried and sized silica (quartz) for industrial uses. Crude material

was transported about 4 miles by truck from the quarry to a screening plant at Gold Hill.

The county was the principal source of copper. Ore was shipped by Golden Road Mining Co. from its open-pit operation. The Warner gold mine, Greenback district, was leased to M & B Logging Co., Canyonville. A 300-foot drift, along a serpentine-porphyry contact zone, was driven below previous workings. The company planned to construct a pilot concentrating mill at the mine.

Jefferson.—The Oregon King mine, Ashwood district, was leased, with option to purchase, by Oregon King Consolidated Mines, Inc. The mine, located on claims originally filed in 1898, had been worked for short periods by various lessees. In 1950, a fire engulfed the shaft above the 300 level, mining ceased, and the operators dropped their lease. Oregon King Consolidated rehabilitated the mine and planned to develop the lower levels. Lead and silver ore from cleanup operations and old stopes was shipped to the American Smelting and Refining Co. smelter, Tacoma, Wash.

Josephine.—The Marble Mountain quarry was operated by Ideal Cement Co. to supply limestone requirements of the company cement plant at Gold Hill. Production at the quarry increased over that of 1961. Sand and gravel and stone output was moderately higher than that of 1961.

Lane.—Output of 3.3 million tons of sand and gravel and 7.1 million tons of stone contributed significantly in placing the county first in terms of value of mineral production. Sand and gravel produced by 12 commercial firms totaled 2.9 million tons; the remainder was supplied by Government-and-contractor producers, mainly for use on Government road projects. Stone output by Government-and-contractor operations was 6.6 million tons; of this, 6.3 million tons was used by the U.S. Army Corps of Engineers in dam-construction projects, and the remainder was used in roadbuilding. Seven commercial stone producers supplied the remaining stone production from 13 quarries.

A 1,662-foot exploration and development adit intersected a mineralized zone approximately 475 feet below the Musick mine workings. This work in the Bohemia district was done by the Emerald Empire Mining Co.

Linn.—Reserve Oil & Gas Co., the first organization to drill for oil in the Willamette Valley in 1962, suspended drilling operations near Lebanon on the Esmond No. 1 well at a depth of 8,603 feet. Reserve Oil operated on leases of Linn County Oil Development Co. under a farm-out arrangement. Humble Oil & Refining Co. abandoned the Miller No. 1 well north of Albany at a total depth of 4,951 feet.

The Bureau of Mines, Albany, completed construction of a high-level gamma-irradiation research chamber. One hundred thousand curies of cobalt 60, contained in 24 capsules, was received from the U.S. Atomic Energy Commission plant at Savannah River, S.C. Research was initiated to determine the effects of gamma radiation on the physical properties of certain metallic and nonmetallic minerals.

Malheur.—Two-State Oil & Gas Co. of Boise, Idaho, commenced operations on a shallow gas test at Vale in April. The attempt was abandoned as a dry hole.

Marion.—Seeking oil structures, Humble Oil & Refining Co. drilled the Wicks No. 1 well to a depth of 7,797 feet, 6 miles east of Silverton.

Multnomah.—Output of sand and gravel was 2.2 million tons, compared with 2.6 million tons in 1961. Less output by commercial firms accounted for the decrease. Stone production declined moderately from the 1961 output. Columbia Brick Works manufactured building brick from clay mined at a company pit southeast of Gresham. Pacific Carbide & Alloys burned limestone barged from a Texada Island, British Columbia, quarry, for use in making calcium carbide. Perlite mined in Nevada was expanded by Supreme Perlite Co. Vermiculite was exfoliated by Vermiculite Northwest, Inc., and Supreme Perlite Co. Soapstone mined in Washington was ground by Miller Products Co. and Stauffer Chemical Co. Natural and artificially colored roofing granules were produced at Portland by The Flintkote Co.

Calcium carbide, ferromanganese, silicomanganese, ferrosilicon, caustic soda, chlorine and rolled- and cast-steel products were produced at chemical and metallurgical plants in Portland. Aluminum oxide from Japan was received at the Port of Portland for shipment to the Harvey Aluminum, Inc., plant at The Dalles. Portland also was a port of entry for foreign base-metal ores and concentrates transshipped to smelters in Idaho and Montana.

Precision Castparts Corp., Portland, manufacturer of investment castings of iron, nickel, and cobalt alloys, planned a $250,000 expansion to provide 24,000 additional square feet of manufacturing plant and 2,500 square feet of new office space.

Polk.—Oregon Portland Cement Co. mined limestone at the Dallas quarry; the material was shipped to Oswego for use at the company cement plant. Clays mined near Monmouth was used to make drain-tile by Monmouth Brick & Tile Co.

John Miller & Associates drilled two shallow, dry test holes searching for petroleum or gas in the vicinity of Ash Creek.

Washington.—Shale quarried near Banks was expanded at the Northwest Aggregate, Inc., plant, and a shale quarry near Vernonia yielded material for bloating at the Smithwick Concrete Products Co. plant. Scholls Tile Co. continued clay production at about the 1961 rate from a pit near Hillsboro.

The Mineral Industry of Pennsylvania

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Pennsylvania Bureau of Topographic and Geologic Survey for collecting information on all minerals except fuels.

By Charles C. Yeloushan,[1] Mary E. Otte,[2] and Robert E. Ela [3]

COMMODITIES produced by the mineral industry of Pennsylvania in 1962 totaled $823 million in value, an increase of $18 million over that of 1961. Mineral fuels accounted for 63 percent of the total; however, their value decreased by $6.4 million. Mineral commodities that increased in total value were portland cement, bituminous coal, cobalt, iron ore, lime, peat, pyrites, sand and gravel, stone, sericite schist, and zinc.

Employment and Injuries.—As shown in table 2 for selected mineral industries, employment continued to decline in the anthracite, bituminous coal, cement, and lime industries. Employment improved somewhat in the clays, sand and gravel, and stone industries because of greater building and construction activity.

Fatalities in the bituminous coal industry increased considerably during 1962, because of a major disaster that claimed the lives of 37 men. It occurred on December 6 in the Robena No. 3 mine of United States Steel Corp. in Greene County. Among the other 22 fatalities, 16 occurred underground, 2 on the surface, and 4 at strip operations. Roof falls accounted for seven of the underground fatalities. Nonfatal lost-time injuries decreased from 1,129 in 1961 to 950.

Twenty-six fatalities occurred in the anthracite industry, seven more than in 1961. Underground fatalities increased from 14 to 18, surface operations from 2 to 5, and strip operations recorded 3 fatalities, the same as in 1961. Of the 18 underground fatalities, 8 were from falls of roof, face, or rib, 5 from suffocation, 2 from transportation, and 1 each from fall of person, inrush of water, and rush of material. Strip and surface fatalities were from miscellaneous causes. Nonfatal lost-time injuries decreased from 1,295 in 1961 to 1,135.

The stone industry recorded 10 fatalities, 9 more than in 1961. Other fatalities occurred in the cement and sand and gravel industries with one each.

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TABLE 1.—Mineral production in Pennsylvania [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland—thousand 376-pound barrels	36,635	$124,506	38,463	$127,969
Masonry—thousand 280-pound barrels	2,678	7,232	2,565	7,105
Clays [2]—thousand short tons	2,999	14,402	2,893	12,815
Coal:				
Anthracite—do	17,446	140,338	16,894	134,094
Bituminous—do	62,652	323,758	65,315	331,298
Gem stones		[3]		4
Lime—thousand short tons	[4] 1,093	[4] 16,428	1,104	16,647
Natural gas—million cubic feet	100,427	29,526	90,053	24,494
Natural gas liquids:				
Natural gasoline—thousand gallons	1,272	74	1,350	75
LP gases—do	1,453	115	1,521	112
Peat—short tons	27,993	291	32,936	369
Petroleum (crude)—thousand 42-gallon barrels	5,643	26,579	[5] 5,225	[5] 23,878
Sand and gravel—thousand short tons	12,594	19,766	14,419	23,587
Stone—do	41,834	71,344	48,144	82,087
Zinc [6] (recoverable content of ores, etc.)—short tons	23,428	5,408	24,308	5,652
Value of items that cannot be disclosed: Cobalt, copper, gold, graphite (1961), iron ore, mica, pyrites, sericite schist, silver, and tripoli		25,356		32,966
Total		[4] 805,128		823,152

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes kaolin: included with "Value of items that cannot be disclosed."
[3] Weight not recorded.
[4] Revised figure.
[5] Preliminary figure.
[6] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at the mine.

Three underground mines in Pennsylvania were winners in the 38th Annual National Safety Competition. Each winning operation achieved the best safety record in one of the major categories of competition during 1962. Each received one of the famed "Sentinels of Safety" trophies for a year. In addition, all employees and officials at winning operations received individual "Certificates of Accomplishment in Safety." On the basis of records submitted, Maple Creek Mine, United States Steel Corp., New Eagle, Washington County, won the top award for underground bituminous coal mines for operating 433,378 man-hours without a disabling injury. This was the second consecutive top award for this mine in its fourth year of continuous competition. It won fourth place in its group in 1960. Bellefonte mine, National Gypsum Co., Bellefonte, Centre County, was the winner in the underground nonmetal mines category for operating 256,667 man-hours without a disabling work injury. This was the second successive year and the fourth time this operation had won in 14 years of continuous competition. It received the trophy in 1949, 1957, and 1961 and honorable mention in 1958 and 1959. Penag mine, Penag Coal Co., Good Springs, Schuylkill County, was the winner in the underground anthracite mine category for operating 163,037 man-hours in 1962 with 18 work injuries causing a loss of 78 days owing to disability. It has competed regularly since 1950 and won top honors in 1956 and honorable mention in 1950, 1951, 1955, 1958, and 1960.

Legislation and Government Programs.—A resource program was initiated to study the problems involved in establishing and maintain-

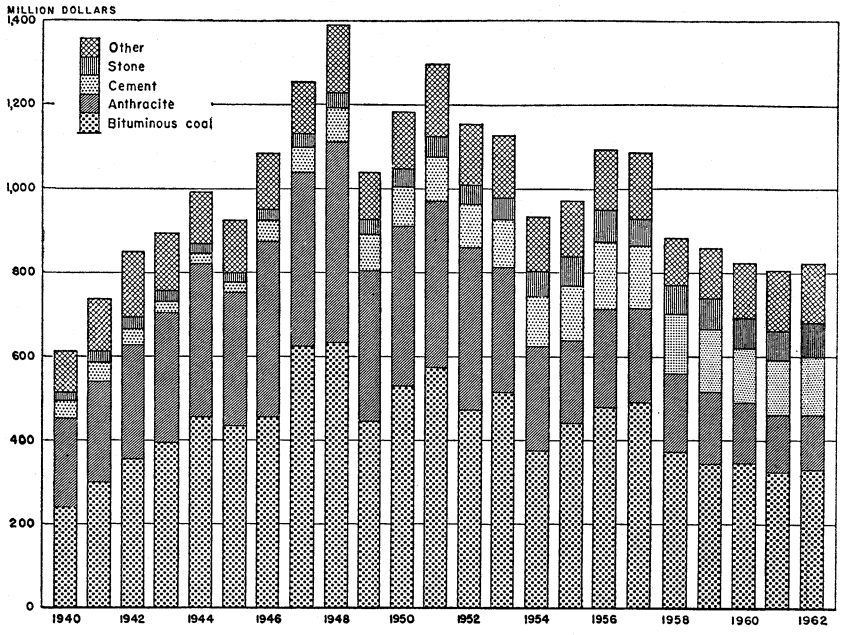

FIGURE 1.—Value of bituminous coal, anthracite, cement, and stone, and total value of mineral production in Pennsylvania, 1940–62.

ing a complete file on the location of active and abandoned bituminous coal mine workings in the Appalachian Region. From this, a program was developed to make a comprehensive investigation of the extent and economic minability of remaining bituminous coal deposits on a county-by-county basis. Preliminary investigation commenced in Butler County.

TABLE 2.—Employment and injuries for selected mineral industries

Industry	1961		1962 [1]				
	Average number of men working	Total man-hours	Average number of men working	Total man-hours	Total number of lost-time injuries		Number of injuries per million man-hours
					Fatal	Nonfatal	
Anthracite	15,792	22,424,285	14,010	18,220,000	26	1,135	63.72
Bituminous coal	27,469	43,152,926	21,700	37,720,000	59	950	26.75
Cement [2]	4,047	9,091,344	3,739	8,499,970	1	15	1.88
Clays	448	684,831	558	967,410	--	24	24.81
Lime [2]	1,177	2,486,350	1,081	2,314,220	--	32	13.83
Sand and gravel	1,392	2,475,592	1,416	2,659,856	1	61	23.31
Stone [3 4]	3,725	7,188,860	3,933	7,697,742	10	204	27.80

[1] Preliminary figures.
[2] Includes quarries or pits producing raw materials used in manufacturing cement or lime for captive operations.
[3] Includes quarry or open-pit employees as well as crushing and screening and rock dressing operations.
[4] Excludes quarries or pits producing limestone from captive operations used in manufacturing cement or lime.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Anthracite).—Production of Pennsylvania anthracite totaled 16.9 million short tons valued at $134 million, a decline of 3 percent and 4 percent, respectively, from 1961.

Freshly-mined anthracite from underground mines accounted for 40 percent of the total tonnage. Production from underground mines was 2 percent less than in 1961. Hand-loaded underground coal totaled 3.6 million tons, compared with 3.4 million tons in 1961. Mechanically loaded underground coal totaled 3.1 million tons, compared with 3.4 million tons in 1961. In all, 128 scraper loaders (4 less than in 1961), 34 mobile loaders (7 more than in 1961), and 536 conveyors and pit-car loaders (80 less than in 1961) were used underground to load anthracite mechanically.

Production from strip pits accounted for 40 percent of the total anthracite tonnage and totaled 6.8 million tons, a 6 percent decrease from 1961 output. Production from culm banks totaled 2.7 million tons (16 percent of total anthracite production), a slight increase over that of 1961. Operations were active in Lehigh, Schuylkill, and Wyoming regions.

Anthracite was dredged from the Schuylkill and Susquehanna Rivers in the Schuylkill region. Production totaled 727,000 tons valued at $2.5 million. Of the total production, 629,000 tons came from the Susquehanna River and 98,000 tons from the Schuylkill River.

Of the total anthracite produced, 7.9 million tons was shipped by rail, 8.8 million tons by truck, and the remainder retained as colliery fuel. The average value of anthracite shipped by rail was $8.06 per ton; by truck, $7.91 per ton; and $3.10 per ton for colliery fuel. Wholesale price indexes (1957–59 equals 100), f.o.b. mines, were 90.9 for chestnut, 92.8 for pea, 92.2 for buckwheat No. 1, and 107.6 for buckwheat No. 3.

Schuylkill County continued to lead other anthracite-producing counties with 6.2 million tons. Luzerne County was second with 6.1 million tons followed by Northumberland with 1.6 million tons, and Lackawanna with 1.1 million tons. Other counties producing anthracite were Carbon, Columbia, Dauphin, Berks, Lancaster, Lebanon, Snyder, Sullivan, Susquehanna, and Wayne.

Coal (Bituminous).—Production of bituminous coal from underground, strip, and auger operations totaled 65.3 million tons, a 4 percent increase over that of 1961. Production from underground mines increased 3 percent; from strip mines, 7 percent; and from auger mines, 35 percent. Mines producing 1,000 tons or more numbered 1,177, compared with 1,220 in 1961. The number of underground mines decreased by 40, strip mines by 9, while auger mines increased by 6.

Underground operations accounted for 65 percent of the total production. Continuous-mining machines accounted for 29.9 million tons; 315 continuous miners loaded 27.1 million tons into shuttle cars, and 40 continuous miners loaded 2.8 million tons onto conveyors. Seventy-seven mobile loaders were used with these continuous mining machines. Mobile loading machines were the principal

coal-moving equipment, with 190 machines loading 8 million tons into shuttle cars, 58 machines loading 1.8 million tons into mine cars, and 13 machines loading 118 thousand tons onto conveyors. Twenty-seven duckbills, self-loading conveyors, and scraper loaders accounted for 186,000 tons. Hand-loaded face conveyors totaled 235 and accounted for 931,000 tons. Cutting machines numbered 748 and cut 12 million tons of coal. Underground haulage included the following: 1,628 electric-trolley, 83 electric-battery, and 24 other type locomotives; 31 rubber-tired tractors; 34,468 rail and 28 rubber-tired mine cars; 841 miles of main line and 332 miles of other rail track; 912 cable-reel and 27 battery shuttle cars; 10 shuttle buggies; and 360 conveyors (average conveyor length 1,637 feet).

Strip mines accounted for 34 percent of the total production. Bituminous coal was stripped and loaded using electrical, diesel-electric, diesel, and gasoline power shovels and draglines. Of the 946 power shovels in use (5 more than in 1961), 880 had a bucket capacity of less than 3 cubic yards; 60, 3 to 5 cubic yards; 4, 6 to 12 cubic yards; and 2, more than 12 cubic yards. Of 411 draglines used, 113 had a bucket capacity of less than 3 cubic yards; 176, 3 to 5 cubic yards; 110, 6 to 12 cubic yards; and 12, over 12 cubic yards. Twenty-nine carryall scrapers were used (16 more than in 1961); 6 had a capacity of less than 3 cubic yards; 10, 3 to 5 cubic yards; 7, 6 to 12 cubic yards; and 6, over 12 cubic yards. In addition, 767 bulldozers, 114 horizontal power drills, 138 vertical power drills, and 1,561 trucks or tractor trailers, having an average capacity of 13 tons per unit, were used.

Sixty augers operated in 56 auger mines. Other equipment used at auger operations included 10 bulldozers, 6 power drills, and 64 trucks or tractor-trailers, having an average capacity of 13 tons per unit.

Of the total bituminous coal production of 65.3 million tons; 50.9 million tons was shipped by rail or water; 12.9 million tons was shipped by truck; 41.6 million tons was sold in the open market at an average price of $4.27 per ton; and 23.7 million tons, not sold in the open market, had an average value of $6.49 per ton. The average values were $5.84 per ton for underground coal; $3.66 per ton for strip coal; and $3.13 per ton for auger coal.

Ninety-one preparation plants (10 more than in 1961) produced 39.7 million tons of clean coal from 51.2 million tons of raw coal. Of the total clean coal, 35.4 million tons came from underground mines, 4.3 million tons from strip mines, and 20,800 tons from auger mines. Wet washing using jigs accounted for 7.2 million tons of clean coal; other methods of wet washing accounted for 26.4 million tons; and pneumatic methods accounted for 6.1 million tons.

Total production of mines having crushing facilities was 45.3 million tons, of which 32 million tons was crushed and 33.6 million tons mechanically cleaned. Total production of mines having treating facilities was 20.4 million tons, of which 359,000 tons was treated with calcium chloride, 4 million tons with oil, 1.1 million tons with both calcium chloride and oil, and 560,000 tons with all other materials.

Coke and Coal Chemicals.—Pennsylvania continued to be the leading producing State for beehive and oven coke. Production from oven-coke operations increased 5 percent. Production from beehive coke ovens decreased 15 percent.

Twelve oven-coke plants with 3,720 slot-type ovens were in existence at yearend, the same as at the end of 1961. Coke-oven operations produced 14 million short tons of coke from the carbonization of 20 million tons of coal for a yield of 69.84 percent. The average value of oven coke at the ovens was $16.36 per short ton, compared with $16.14 per ton in 1961. Of the oven coke made in Pennsylvania, producers used 13.1 million tons in blast furnaces and 24,000 tons for other purposes. Sales were 295,000 tons to blast-furnace plants, 181,000 tons to foundries, 140,000 tons to other industrial plants, and 167,000 tons for residential heating.

Twenty-one beehive coke plants with 3,918 ovens were in existence at yearend, compared with 27 plants and 4,493 ovens at the end of 1961. Beehive operations produced 384,800 tons of coke from the carbonization of 630,300 tons of coal, for a yield of 61.06 percent. The average value of beehive coke at the ovens was $13.67 per ton, compared with $13.76 per ton in 1961. Of the beehive coke produced in Pennsylvania, producing companies used the major portion of the output in their own blast furnaces, but some was sold to outside blast-furnace plants, foundries, other industrial plants, and also for residential heating.

Production of breeze recovered at coke plants totaled 649,000 tons valued at $4.5 million. Most of the breeze tonnage was used by the producers in steam plants, agglomerating plants, and other industrial uses. A small quantity was sold. Yearend stock of breeze totaled 220,000 tons.

Coal delivered during the year to Pennsylvania oven-coke plants totaled 19.7 million tons, of which 10.7 million tons was produced in Pennsylvania; 7.2 million tons in West Virginia; 1 million tons in Virginia; and 756,000 tons in Kentucky. The coal received by coke-oven operators in Pennsylvania was 71 percent high volatile, 10 percent medium volatile, and 19 percent low volatile coal.

Coal-chemical materials produced at coke-oven installations in Pennsylvania included 210 billion cubic feet of coke-oven gas, 199,000 tons of ammonium sulfate equivalent, 196 million gallons of coke-oven tar, and 62,342,390 gallons of crude light oil, from which was derived 32,892,301 gallons of benzene, 8,545,043 gallons of toluene, 3,038,864 gallons of xylene, and 2,180,857 gallons of solvent naphtha.

Peat.—Production of peat increased 18 percent in total tonnage and 27 percent in total value over that of 1961. Peat was produced in Erie, Lawrence, Luzerne, Monroe, and Wayne Counties. The leading producer was Wayne County. Humus peat, sold in bulk, comprised most of the tonnage. Some moss and reed-sedge peat were also produced. Peat was sold in packages and in bulk.

Petroleum and Natural Gas.—Production of crude petroleum decreased from 5.6 million barrels valued at $26.6 million in 1961 to 5.2 million barrels valued at $23.9 million. The average value per barrel of crude oil remained constant throughout 1962 at $4.63 per barrel in the northern or Bradford district, $4.35 per barrel in the middle or Venango district, and $4.08 per barrel in the southwestern district.

Production of natural gas decreased from 100.4 billion cubic feet valued at $29.5 million in 1961 to 90.1 billion cubic feet valued at $24.5 million.

Exploration resulted in the discovery of one new gas field, three new gas pools, and one deeper gas pool.[4] One of the new gas pools was discovered by reactivating an old well, abandoned as a dry hole, and fracturing the producing horizon. Other fields and pools were extended by development drilling.

The outstanding discovery was the Five Forks field in Bedford County in a highly folded area of the Valley and Ridge province. Other important discoveries were the Kastle pool in the Medina play in Crawford County, the Newfield pool on the Harrison anticline in Potter County, the Hribal pool on the northwestern flank of the Chestnut Ridge anticline in Westmoreland County, and the Kahl pool on the Fayette anticline in Westmoreland County. All the discoveries were in formations of Middle Devonian Age or older. The greatest amount of deep drilling (Middle Devonian or older) occurred in the Whippoorwill field in Elk and Cameron Counties, where 15 gas wells and 3 dry holes were completed during 1962. There were 668 new wells drilled and 40 wells deepened. Of the 668 new wells, 630 were in proven fields, and 38 were exploratory tests. Included in the 38 exploratory tests was a reactivated well, which discovered a new pool, and an unsuccessful shallow (Upper Devonian or younger) wildcat. The remaining 36 wells were all deep wildcats. Of the 630 proven field wells, 341 were drilled outside of underground gas storage and secondary recovery projects, 286 wells in secondary recovery projects, and 3 wells in gas storage fields. Of the 341 development wells outside secondary recovery projects, 97 were oil wells, 189 gas wells, and 55 dry holes. The total footage drilled during 1962 was 1,716,482 feet.

Out of 102 deep wells (Middle Devonian or older) drilled during 1962, 36 wells were wildcats. This is one less wildcat well than was drilled in 1961. Crawford and Erie Counties in Northwestern Pennsylvania had the greatest density of deep drilling with 17 deep wells completed in each county. Cameron County was next with 16 deep wells. The 102 deep wells consisted of 56 gas wells, 2 gas storage wells, and 44 dry holes. Two old deep wells were reactivated and drilled deeper. The total deep footage, including the two old wells drilled deeper, amounted to 583,288 feet. Rotary tools completed 81 deep wells during the year, most of them with air rotary, and 21 were completed with cable tools. There were 564 shallow-sand wells completed in 1962. The total shallow footage drilled, including 38 wells deepened was 1,133,194 feet. Indiana County had the greatest activity in the shallow-sand gas belt. Thirty-one new gas wells were completed in the county, of which 28 were fractured. Armstrong County had 29 new gas wells; Westmoreland, 26; and Clarion, 22.

A total of 97 oil wells was drilled outside the secondary recovery projects. The greatest number of oil wells was drilled in Warren County, with 59 completed. Venango County was second with 20 oil wells. The increase in drilling in the Warren area was attributed to the success of fracturing Glade sand wells. At the end of the year 26 Glade sand wells had been drilled and fractured. Of these oil wells, 17 were drilled in the Warren area, and 9 in the Sugar Grove area.

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[4] Lytle, William S., Addison S. Cate, William G. McGlade, and Walter R. Wagner. Oil and Gas Developments in Pennsylvania in 1962. Pennsylvania Geol. Survey, Prog. Rept. 165, 1963, 44 pp.

Exploratory tests totaled 38, drilling a total of 235,146 feet. Among the exploratory tests, 5 were successful, and 33 were dry, giving a success ratio of 1 in 7.6.

Seismic crews logged 83 weeks, a decrease of 38 percent from the seismic activity in 1961. Gravity crews logged 7 weeks in Susquehanna, Lackawanna, and Monroe Counties. Geological field parties were also active, especially in the Valley and Ridge province.

Proved reserves of crude oil at yearend were estimated at 96.7 million barrels. Proved recoverable reserves of natural gas in Pennsylvania at yearend were estimated at 1,181 billion cubic feet. Natural gas held in underground reservoirs for storage purposes at yearend totaled 453 billion cubic feet. The total reservoir capacity for the storage of natural gas was estimated at 512.1 billion cubic feet, compared with 497 billion cubic feet in 1961.

Natural Gas Liquids.—Total production of natural gas liquids increased from 2.7 million gallons in 1961 to 2.9 million gallons. Of the total, natural gasoline and cycle products accounted for 1.4 million gallons, and liquefied petroleum gases and ethane (manufactured at natural gasoline plants) accounted for 1.5 million gallons. Average value for natural gasoline and cycle products decreased from $0.058 per gallon in 1961 to $0.056, and for liquefied petroleum gases and ethane from $0.079 per gallon in 1961 to $0.074.

Estimated proved reserves of natural gas liquids at yearend totaled 1.5 million barrels, compared with 2.1 million barrels at the end of 1961. Estimated proved reserves of liquid hydrocarbons at yearend totaled 98 million barrels, compared with 104 million barrels at the end of 1961.

NONMETALS

Cement.—Production of portland and masonry cements increased 8 percent and 1 percent, respectively. Shipments of portland cement increased 5 percent and had an average value of $3.33 per barrel compared with $3.40 per barrel in 1961. Masonry cement shipments decreased 4 percent and had an average value of $2.77 per barrel compared with $2.70 per barrel in 1961. Portland cement was converted into prepared masonry cement at six plants at various locations throughout the State during 1962 and totaled 268,900 barrels, a 14-percent decrease from 1961 output.

The portland cement industry operated at 74 percent of annual finished-cement capacity. There were 22 active plants. Dry process plants accounted for 69 percent of the capacity and wet process plants, 31 percent. Electrical energy consumption was 972 million kilowatt-hours, a 9-percent increase over that of 1961. Seventy-nine percent of the electrical energy consumed was purchased from public utility companies. Portland cement stocks increased 15 percent during 1962, totaling 6.2 million barrels at yearend.

Cement rock and limestone were the principal raw materials used in manufacturing portland cement, and accounted for 92 percent of the total raw material used with tonnages of 8.2 million and 3.3 million, respectively. Other raw materials included gypsum (321,800 tons), slag (248,600 tons), and sand (208,000 tons), accounting for an additional 6 percent of the total. Smaller quantities of clay, shale, iron ore, slate, mill scale, pyrites, sludge, iron cinders, carbon black,

and air-entraining compounds composed the remaining tonnage used as raw material.

Shipments of finished portland cement were distributed to consumers in Pennsylvania, 44 other States, the District of Columbia, and foreign countries. Destinations of most of the shipments were as follows: 35 percent to Pennsylvania; 22 percent to New Jersey; 17 percent to New York; 6 percent each to Ohio and Connecticut; 4 percent to Maryland; 3 percent to Massachusetts; and 2 percent each to Delaware and Virginia.

Shipments of portland cement by type of customer were as follows: 20.9 million barrels to ready-mixed concrete companies, 7.5 million barrels to concrete product manufacturers, 6 million barrels to building material dealers, 2.9 million barrels to highway contractors, 680,000 barrels to other contractors, 416,000 barrels to miscellaneous customers, and 15,000 barrels to Federal, State, and local government agencies.

Shipments of prepared masonry cement were distributed to consumers in Pennsylvania, 25 other States, and the District of Columbia. Destinations of most of the shipments were as follows: 38 percent to Pennsylvania, 19 percent to New Jersey, 16 percent to New York, and 13 percent to Ohio. Masonry cement production was reported by 16 of the portland cement plants. Northampton, Lawrence, and Lehigh Counties were the principal producing counties.

TABLE 3.—Portland cement shipments, by counties

County	Number of plants in 1962	1961		1962	
		Barrels	Value	Barrels	Value
Lehigh	4	6,606,106	$21,718,671	6,580,842	$21,041,268
Northampton	10	18,156,481	61,222,857	19,324,721	63,525,400
Allegheny	2	6,391,919	21,831,403	6,397,052	21,250,020
Lawrence	2				
Berks	1	5,480,152	19,732,766	6,160,200	22,152,731
Butler	1				
Montgomery	1				
York	1				
Total	22	36,634,658	124,505,697	38,462,815	127,969,419

Clays.—Production of clays declined for the second consecutive year. Increased consumption of clay for cement and lightweight aggregates was not sufficent to overcome the decrease in consumption for refractories and heavy clay products. Clay production was reported from 126 operations, of which 111 were strictly clay mines. Other operations were in conjunction with coal and limestone mining. Of the clay mines reported, 89 were open pit and 22 were underground. Fire clay was used principally in manufacturing refractory firebrick and block and heavy clay products and smaller quantities were used as filler. Thirty-four percent of the fire clay sold and used was mined underground. Clearfield County was the leading county for the production of fire clay, followed by Armstrong and Lawrence Counties. Miscellaneous clay tonnage increased 5 percent from 1961. Higher demand for miscellaneous clay for heavy clay products, lightweight aggregate, and cement were factors accounting for the increase. All

of the miscellaneous clay came from open pits. Schuylkill County was the leading producer of miscellaneous clay, followed in decreasing order by Berks and Lawrence Counties.

Production of kaolin, which decreased 4 percent in tonnage from 1961, was used in the manufacture of firebrick and block, portland cement, and heavy clay products. Kaolin was recovered from open pits in Blair and Cumberland Counties.

TABLE 4.—Clays sold or used by producers, by kinds and uses [1]

Use	Fire clay		Miscellaneous clay	
	1961	1962	1961	1962
Refractories:				
Firebrick and block	684,376	611,313		
Fire clay mortar	14,109	13,253		
Clay crucibles	13,098	2,012		
Foundries and steelworks	58,273	57,157	(2)	(2)
Heavy clay products	606,341	516,826	(2)	1,246,641
Portland and other hydraulic cements			136,430	(2)
Undistributed	[3] 88,423	[3] 75,584	[4] 1,398,410	[4] 370,676
Total	1,464,620	1,276,145	1,534,840	1,617,317

[1] Excludes kaolin.
[2] Included with "Undistributed" to avoid disclosing individual company confidential data.
[3] Includes high-alumina brick, glass refractories, other refractories, rubber (1962), and insecticides and fungicides (1962).
[4] Includes art pottery, flowerpots and glaze slip, floor and wall tile (1961), lightweight aggregate, linoleum and oilcloth, other uses, and items indicated by footnote 2.

TABLE 5.—Clays sold or used by producers in 1962, by counties

County	Short tons	Value	Types of clay
Adams	75,900	$38,400	Miscellaneous clay.
Allegheny	86,254	449,606	Do.
Armstrong	203,649	1,892,926	Fire clay.
Butler	14,346	21,519	Miscellaneous clay.
Clarion	82,927	359,633	Fire clay, miscellaneous clay.
Clearfield	361,912	2,570,455	Do.
Columbia	14,095	25,372	Miscellaneous clay.
Fayette	68,331	248,609	Fire clay, miscellaneous clay.
Lawrence	372,827	623,469	Do.
Montgomery	87,156	133,956	Do.
Snyder	19,982	24,977	Miscellaneous clay.
Somerset	58,240	(1)	Fire clay.
Undistributed [2]	1,447,843	6,425,951	
Total [3]	2,893,462	12,814,873	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes Beaver, Berks, Blair, Bucks, Cameron, Centre, Chester, Clinton, Dauphin, Elk, Greene, Huntingdon, Indiana, Jefferson, Lancaster, Luzerne, McKean, Monroe, Northumberland, Schuylkill, and York Counties, and item indicated by footnote 1.
[3] Incomplete total; excludes kaolin produced in Blair and Cumberland Counties.

Gem Stones.—Small quantities of semiprecious gem stones and mineral specimens continued to be collected in eastern Pennsylvania by hobbyists and members of various local and out-of-State mineral and lapidary clubs. Activity was centered in Chester and Montgomery Counties. Mineral specimens were also reported as having been collected in Lancaster, Lehigh, Luzerne, Monroe, and Northampton Counties. Minerals collected included garnet, jasper, quartz, marcasite, galena, malachite, flint, zeolite, hematite, stilbite, natrolite, and deweylite.

Graphite.—Artificial graphite was produced at a plant in Elk County and sold to principal basic steel manufacturers, iron and steel foundries, and to the electrochemical industry. The operation recovering natural graphite from schist in Chester County was inactive during 1962.

Iron Oxide Pigments.—Sulfur mud continued to be produced as a crude iron oxide pigment material in Cambria County and shipped to finishing plants in Northampton and Carbon Counties. Production decreased 35 percent from that of 1961, because of a lack of orders.

Finished natural and manufactured iron oxide pigments continued to be produced at two plants in Northampton County and one plant in Carbon County. Production increased 8 percent in total tonnage and 7 percent in total value from 1961. Finished pigment products included magnetite, manufactured magnetic black, natural and manufactured brown iron oxide, raw and burnt sienna, raw and burnt umber, Vandyke brown, natural and manufactured red iron oxide, Venetian red, pyrite cinder, manufactured yellow iron oxide, ocher, and others. Manufactured red iron oxide accounted for most of the total market value for pigments. Pennsylvania continued to be the leading State in the production of finished natural and manufactured iron oxide pigments.

Lime.—Production of quicklime and hydrated lime increased slightly over that of 1961. Quicklime accounted for 67 percent of the total lime sold. Shipments of quicklime for construction, agricultural, refractory, and chemical purposes decreased 9 percent. Shipments of hydrated lime for construction, agricultural, and chemical purposes increased 28 percent.

Sixteen companies, 4 less than in 1961, operated 18 plants in 14 counties. Centre County continued to be the leading county producing 46 percent of the State lime shipments. Centre, York, Lebanon, Butler, Chester, and Montgomery Counties, in decreasing order, each produced lime valued in excess of $1 million. Most of the lime was consumed within the State (57 percent), but large quantities were shipped to New York (9 percent), New Jersey (8 percent), Ohio (5 percent), Delaware (4 percent), and Maine (2 percent).

TABLE 6.—Lime sold by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Centre	500,707	$6,746,673	502,752	$6,732,596
Dauphin	7,900	126,400	8,000	128,000
Franklin	1,557	11,833	----	----
Fulton	593	5,337	----	----
Juniata	----	----	1,482	15,190
Lancaster	1,198	16,772	841	10,077
Lebanon	142,000	2,070,000	137,000	1,998,000
Mifflin	4,349	42,521	(1)	(1)
Northumberland	417	3,450	337	3,031
Snyder	739	6,073	1,135	9,202
Undistributed [2]	433,242	7,398,581	452,009	7,750,806
Total	[3] 1,092,702	[3] 16,427,640	1,103,556	16,646,902

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes Armstrong, Bedford, Butler, Chester, Montgomery, and York Counties, and county indicated by footnote 1.
[3] Revised figure.

Magnesium Compounds.—Precipitated magnesium carbonate was produced from raw dolomite at a plant in Montgomery County. Production was considerably higher than in 1961, but the company reported the plant closed at yearend because of unprofitable operations. Extralight magnesium oxide was produced from precipitated magnesia at the same plant for manufacturing rubber and magnesium oxide insulation.

Mica.—Scrap mica was produced and processed at an operation in York County. Mica was ground with air separation to 160- and to 325-mesh size. The 160-mesh mica was used as a mold lubricant in the rubber industry and in welding rods; the 325-mesh size was used in paints and plastics.

Perlite (Expanded).—Crude perlite, mined in Colorado, was expanded at plants in Allegheny, Delaware, Lehigh, Montgomery, and York Counties. Sales of expanded perlite totaled 14,362 tons valued at $935,547, a decrease from 1961. The building plaster industry consumed most of the expanded perlite production, but other uses included loose-fill insulation, concrete aggregate, soil conditioning, filler, formed insulation, soakup, and filter aid.

Pyrites.—Pyrites were recovered as a byproduct concentrate of magnetic ore by flotation at two concentrators in Lebanon and Berks Counties. Production of pyrites increased 30 percent over 1961. The pyrites were used for making sulfuric acid.

Sand and Gravel.—Production of sand and gravel totaled 14.4 million short tons, the highest level since 1953. Production was reported from 46 of the 67 counties. Sand and gravel for building and paving purposes totaled 12.3 million tons. The operations reporting sand and gravel production numbered 114, of which 35 produced over 100,000 tons. Production from these 35 plants totaled 11.6 million tons and represented more than 80 percent of the State total. Bucks County continued as the leading producing county followed by Erie, Armstrong, and Huntingdon. Industrial sand was produced in 17 counties, led by Huntingdon and Mifflin Counties. Seventy-two percent of the total sand and gravel tonnage was transported by truck. Other methods of shipment were by waterway and railroad. Pennsylvania ranked 18th in U.S. sand and gravel production.

Stone.—Total production of stone increased 15 percent in tonnage and value from 1961. The increase was caused mainly by the greater demand for crushed stone for concrete and roadstone uses in building and highway construction.

Stone was produced in 49 counties, 1 more than in 1961. Northampton County continued to be the leading stone-producing county. Counties producing over $3 million were, in decreasing order, Northampton, Montgomery, Adams, York, Berks, Lancaster, Chester, Centre, Lawrence, and Bucks Counties. In addition, Blair, Bulter, Cumberland, Dauphin, Delaware, Fayette, Franklin, Huntingdon, Lebanon, Lehigh, and Westmoreland Counties each produced over $1 million worth of stone.

Production of basalt (traprock) totaled 3.3 million tons valued at $6.5 million, increases of 1 and 7 percent, respectively, over those of 1961. Dimension basalt stone was produced in Bucks, Chester, and Montgomery Counties. Crushed basalt stone was produced in Adams, Berks, Bucks, Chester, Dauphin, Delaware, and Montgomery Counties.

TABLE 7.—Sand and gravel sold or used by producers, by classes of operations, and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Molding	148	$427	141	$405
Building	3,820	5,102	4,493	6,511
Paving	1,853	2,657	2,562	3,777
Fire or furnace	227	470	169	386
Engine	65	172	(1)	(1)
Fill	80	59	31	30
Undistributed [2]	1,096	3,815	1,529	4,762
Total	7,289	12,702	8,925	15,871
Gravel:				
Construction:				
Building	3,175	4,170	2,510	3,433
Paving	1,941	2,747	2,748	4,070
Fill	93	63	130	83
Undistributed [3]	37	42	106	130
Miscellaneous	59	42	(1)	(1)
Total	5,305	7,064	5,494	7,716
Grand total	12,594	19,766	14,419	23,587

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes glass, grinding and polishing, blast, ferrosilicon, ground, and other sand, and items indicated by footnote 1.
[3] Includes railroad ballast, other uses, and items indicated by footnote 1.

TABLE 8.—Sand and gravel sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Allegheny	205,136	$353,997	210,362	$370,714
Armstrong	1,462,726	3,010,348	1,208,969	2,492,159
Bedford	4,590	12,622	(1)	(1)
Berks	(1)	(1)	85,544	141,789
Bradford	290,002	405,602	(1)	(1)
Butler	136,196	158,037	135,246	166,110
Cambria	8,740	20,717	(1)	(1)
Carbon	(1)	(1)	217,553	314,953
Crawford	107,813	122,527	(1)	(1)
Cumberland	144,846	224,784	222,370	326,490
Fayette	119,940	202,524	162,000	349,000
Jefferson	10,000	4,200	9,000	3,600
Lackawanna	237,546	294,471	186,348	189,851
Lancaster	219,321	394,708	206,016	360,020
Luzerne	348,173	438,494	433,309	522,928
Mercer	401,165	537,918	222,887	293,684
Monroe	61,668	66,158	77,688	84,980
Northampton	523,905	627,011	461,270	550,396
Northumberland	5,215	10,025		
Schuylkill	122,734	271,340	91,482	220,719
Somerset	770	2,310	850	2,680
Venango	309,681	589,126	(1)	(1)
Warren	(1)	(1)	156,091	226,253
Wayne	1,679	2,017	(1)	(1)
Wyoming	448,118	438,374	(1)	(1)
York	256,725	382,111	(1)	(1)
Undistributed [2]	7,167,434	11,196,516	10,331,537	16,970,309
Total	12,594,123	19,765,937	14,418,522	23,586,635

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes Beaver, Blair, Bucks, Clarion (1962), Columbia, Dauphin, Elk, Erie, Forest, Franklin, Fulton, Huntingdon, Lawrence, Lehigh (1962), Lycoming, McKean, Mifflin, Montgomery, Montour, Philadelphia, and Snyder Counties, unspecified counties (1961), and counties indicated by footnote 1.

Granite production increased 17 percent in tonnage and 12 percent in value over the 1961 output. Dimension granite was produced in Delaware County, and both dimension and crushed granite in Montgomery.

Miscellaneous stone production totaled 865,400 tons valued at $1.4 million, increases of 68 and 66 percent, respectively, from 1961. Crushed stone accounted for 97 percent of the miscellaneous stone production and was produced in Bucks and Montgomery Counties. Dimension stone was produced in Delaware and Montgomery Counties. Sandstone production totaled 2.1 million tons valued at $7.3 million, an increase of 30 and 25 percent, respectively, over 1961 totals. Crushed stone accounted for 96 percent of the sandstone production and was produced in 27 counties led by Westmoreland County with 584,000 tons. Dimension sandstone was produced in 13 counties led by Chester County with 17,300 tons.

Limestone production increased 15 percent in total tonnage value over that of 1961. Crushed limestone production totaled 41.5 million tons valued at $62.4 million. The cement industry consumed 11.2 million tons of crushed limestone and the lime industry 2 million tons. Concrete and roads accounted for 21 million tons of crushed limestone; flux, for 4.6 million tons; and agricultural purposes, for 1.2 million tons. Crushed limestone was produced in 37 counties, led by Northampton County with 5.4 million tons. Other leading counties, each producing over 2 million tons, were Adams, Berks, Centre, Chester, Lancaster, Lawrence, Lehigh, Montgomery, and York Counties. Output of dimension limestone, produced only in Bucks County, decreased.

Dimension slate production totaled 53,460 tons valued at $3.7 million, increases of 14 and 6 percent over that of 1961. Flagging accounted for 24,880 tons; roofing, for 12,070 tons; and structural and sanitary uses, for 10,160 tons. Dimension slate was produced in Northampton and Lehigh Counties. Crushed slate was produced in York, Northampton, and Lycoming Counties and was used chiefly for natural granules and flour. Production of crushed slate decreased in tonnage and value from that of 1961.

Natural roofing granules were produced in Adams and York Counties. Production was slightly below that of 1961. Artificially colored roofing granules were produced in Adams and Beaver Counties. Production increased considerably over 1961 output. Artificially colored granules represented 84 percent of the total roofing granule production.

Sulfur.—Brimstone (sulfur) was recovered as a byproduct in the liquid purification of gas at two refineries in Delaware County and one refinery in Philadelphia County by various processes. Production totaled 30,900 long tons of sulfur equivalent. Shipments totaled 31,100 tons of sulfur equivalent valued at $725,400. This was a 13-percent decrease from that marketed in 1961. Hydrogen sulfide was recovered by the Girdler system using diethanolamine and monethanolamine at a Philadelphia refinery for use in the manufacture of acid. Sulfuric acid (100 percent basis) was recovered at zinc smelters and zinc roasters in Beaver and Carbon Counties.

Talc.—Sericite schist (classed as talc for statistical purposes) was produced at three locations in Adams County. Production increased 20 percent over that of 1961. The crude material was ground and

TABLE 9.—Stone sold or used by producers, by uses

Use	1961		1962	
	Short tons	Value	Short tons	Value
Dimension stone:				
Building stone	143,644	$1,128,525	146,721	$1,232,061
Curbing and flagging	11,372	278,501	11,987	308,245
Other uses	46,891	3,445,385	53,458	3,664,616
Total	201,907	4,852,411	212,166	5,204,922
Crushed and broken stone:				
Concrete and roadstone	21,342,700	31,563,484	26,471,466	39,184,889
Furnace flux (limestone)	4,924,382	8,953,062	4,566,923	8,448,314
Railroad ballast	641,882	1,003,118	603,870	938,465
Agricultural	1,078,392	2,973,326	1,075,943	3,306,754
Other uses [1]	13,645,002	21,998,505	15,213,556	25,003,504
Total	41,632,358	66,491,495	47,931,758	76,881,926
Grand total	41,834,265	71,343,906	48,143,924	82,086,848

[1] Includes riprap and refractory.

TABLE 10.—Stone sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Adams, Cumberland, York	5,001,344	$10,420,308	6,105,873	$12,622,809
Armstrong	50,111	100,094	(1)	(1)
Berks	2,672,193	3,409,104	3,200,677	4,823,352
Blair, Huntingdon	1,149,020	2,070,070	1,355,747	3,496,433
Bucks	1,513,394	2,756,661	1,671,151	3,050,563
Butler	715,986	1,390,315	1,185,839	2,325,491
Cambria	4,000	14,000	5,000	15,000
Carbon, Monroe, Schuylkill	555,742	1,847,976	897,183	2,207,521
Centre	1,972,355	3,950,176	2,027,577	4,124,154
Chester	2,087,985	3,890,230	2,559,595	4,246,967
Dauphin	1,478,325	2,313,959	1,102,812	1,770,328
Fayette, Somerset	772,894	1,592,048	1,495,280	2,866,745
Franklin	533,193	854,227	782,139	1,212,870
Juniata, Mifflin, Snyder	799,172	1,458,543	724,316	1,256,552
Lancaster	2,586,503	3,733,888	3,121,121	4,687,386
Lawrence	2,665,362	4,407,352	2,519,025	4,030,229
Lebanon	1,294,165	2,283,741	1,358,550	2,362,525
Lehigh, Northampton	6,921,657	9,467,198	7,956,320	10,069,009
Luzerne	149,407	234,993	327,516	533,601
Mercer	17,264	59,702	(1)	(1)
Montgomery	3,959,509	6,757,063	4,172,474	6,812,006
Northumberland	42,334	73,884	48,538	85,916
Potter	(1)	(1)	7,160	205,132
Union	333,675	538,017	(1)	(1)
Wayne	99,948	191,048	(1)	(1)
Westmoreland	(1)	(1)	651,592	1,101,029
Undistributed [2]	4,458,727	7,529,309	4,868,439	8,181,229
Total	41,834,265	71,343,906	48,143,924	82,086,848

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes Allegheny, Bedford, Clarion, Clinton, Delaware, Fulton, Lackawanna, Lycoming, Montour, Perry, Susquehanna, Tioga (1962), Washington, and Wyoming Counties, and counties indicated by footnote 1.

used for asphalt filler, insecticides, roofing, joint cement, and other purposes.

Tripoli.—Production of crude tripoli (rottenstone) was slightly lower. Crude material was produced and ground at two locations in Lycoming County and used as an abrasive in buffing compounds,

metal polish, cleansing and scouring soaps, and similar mixtures, and as a filler.

Vermiculite (Exfoliated).—Crude vermiculite from Montana, South Carolina, and Southern Rhodesia was exfoliated at two plants in Bucks and Lawrence Counties. The product was used for many purposes including home insulation and packing, concrete aggregate, plastering aggregate and packing, and horticultural uses.

METALS

Beryllium.—The Beryllium Corp. of Reading and Hazelton processed beryl to beryllium metal, alloys, and compounds. Most of the output was beryllium metal and beryllium-copper alloys.

Cadmium.—Shipments of primary cadmium metal, recovered from flue dust, collected at the Palmerton smelter of New Jersey Zinc Co. and at the Josephtown plant of St. Joseph Lead Co., increased 22 percent from 1961.

Cobalt.—Concentrates of cobalt were produced by the Bethlehem Cornwall Corp. from magnetite ores processed at its Cornwall operation in Lebanon County and at its Morgantown operation in Berks County. Production was greater than in 1961. The concentrate was processed into metal, oxide, and hydrate by a company in Wilmington, Del.

Copper.—Concentrates of copper were recovered from magnetite processed in Lebanon County. Production was less than in 1961.

Ferroalloys.—Production of ferroalloys increased from 448,678 short tons in 1961 to 513,221 tons. Shipments totaled 455,538 tons valued at $95.4 million. Ferromanganese accounted for 90 percent of the shipments. The remaining shipments consisted of spiegeleisen, ferrotungsten, aluminum-vanadium, ferrovanadium, ferroboron, ferrocolumbium, nickel-columbium, ferromolybdenum, and aluminum-chromium-vanadium.

Gold and Silver.—Gold and silver were recovered from copper concentrates produced by Bethlehem Cornwall Corp. at its Cornwall concentrator in Lebanon County.

Iron Ore.—Magnetite was produced from two underground mines, Grace mine near Morgantown, Berks County, and Cornwall mine near Cornwall, Lebanon County. Concentrators at each mine processed the crude ore by grinding it to a fine powder and magnetically separating ore from waste. A small tonnage of concentrates from the new Cornwall concentrator was shipped to consumers, but the remaining tonnage was processed into pellets in the agglomerating section of the concentrator. All the concentrate production at Morgantown concentrator was processed into pellets in the agglomerating section of the concentrator. Shipments of pellets increased considerably from 1961.

Iron and Steel Scrap.—Consumption of iron and steel scrap totaled 12,682,000 short tons, a 2-percent increase from 1961. Scrap was collected and prepared chiefly in the larger metropolitan areas such as Pittsburgh, Philadelphia, and Harrisburg. The leading varieties of scrap processed and shipped were No. 1 heavy melting steel, No. 2 and all other bundles, cast-iron scrap and other borings, and No. 1 and electric furnace bundles. Consumer stocks of iron and steel scrap in Pennsylvania at yearend totaled 1,894,500 tons.

Pig Iron.—Pig iron was produced by 11 companies at 18 plants and totaled 15.7 million short tons compared with 15.2 million tons in 1961. Basic pig iron was produced at 17 plants, foundry pig iron at 5 plants, bessemer pig iron at 6 plants, low-phosphorus pig iron at 2 plants, malleable pig iron at 5 plants, and direct-casting pig iron at 3 plants.

Basic pig iron accounted for 90 percent of the total pig iron production and malleable pig iron, 3 percent. Blast furnaces in blast during 1962 totaled 51 and consumed the following raw material: 5.1 million tons of domestic iron ore, 2.3 million tons of foreign iron ore, 1.6 million tons of limestone, 1.1 million tons of dolomite, 657,000 tons of mill cinder and roll scale, 1.2 million tons of open-hearth, basic oxygen, and bessemer slag, 10.8 million tons of coke, 895,000 tons of home and purchased scrap, 138,000 tons of slag scrap, and 111,000 tons of other materials. In addition, various quantities of manganiferous ores (foreign and domestic), flue dust, coke breeze, pig iron, and hot metal were consumed in blast furnaces.

Slag (Iron-Blast-Furnace).—Iron-blast-furnace slag processed in Pennsylvania decreased from 6.7 million short tons in 1961 to 6.2 million tons. The value of slag also decreased from $11.4 million in 1961 to $11.1 million. Pennsylvania continued to be the leading producer of iron-blast-furnace slag, with 27 percent of the U.S. tonnage. Of the slag processed in Pennsylvania, 80 percent was screened air-cooled slag used chiefly as an aggregate in highway and airport construction, bituminous construction, portland-cement concrete construction, and for railroad ballast.

Smelters.—Two zinc smelters were active during the year, the Josephtown smelter of St. Joseph Lead Co. and the Palmerton smelter of The New Jersey Zinc Co. The Josephtown zinc smelter processed zinc concentrates from company operations in New York and Missouri and purchased material from other States and foreign countries. The zinc content of metal and oxide production for the Josephtown smelter reached a record high of 153,968 tons, compared with 141,209 tons in 1961. The smelter operated on a 48-hour-week basis during the entire year. The Palmerton smelter processed zinc concentrates shipped from company operations at Friedensville, Pa.; Austinville, Va.; Cannon City, Colo.; Jefferson City, Tenn., and purchased material from various suppliers in other States and foreign countries. The smelter also processed some lead concentrates shipped from Austinville, Va. Construction of the first of two electric furnaces for the production of spiegeleisen and other ferroalloys was completed at Palmerton. The new facility, which replaced the old blast-furnace system, started operations in November. Four additional zinc dust furnaces of improved design were also installed and put in operation at Palmerton.

Zinc.—Zinc ore was produced at the Friedensville mine of The New Jersey Zinc Co. and concentrated at a nearby plant. The concentrate was shipped to the company smelter at Palmerton. The Friedensville mine reported increased production compared with 1961 despite difficult drainage conditions.

REVIEW BY COUNTIES

Adams.—Total production of stone increased 35 percent over 1961. Bethlehem Limestone Co. quarried and crushed limestone at an opera-

tion near Hanover. Uses were for flux in iron and steel manufacture, concrete, railroad ballast, agricultural purposes, clay filler, and stone sand. The firm began operating a new processing plant at Hanover that was designed to crush and screen limestone at the rate of 1,200 tons per hour and produce metallurgical material for Bethlehem Steel mills and commercial aggregates. Teeter Stone, Inc., near Gettysburg, and Gettysburg Limestone Products, Inc., near Fairfield, quarried limestone for concrete and roads. The Ruberoid Co., Roofing Granule Division, crushed and ground stone at its Greystone quarry (quartzite) and the Green Spoils dump (basalt) near Charmian for use as roofing granules, tennis court surfacing, asphalt filler, and stone dust. Sericite schist was recovered by Summit Industries, Inc., at two open-pit mines near Mount Hope and Bendersville and trucked to the company plant at Aspers to be ground. The product was used for asphalt filler, insecticides, and joint cement. Mauna Mining Corp. produced pyrophyllite (sericite schist for statistical purposes) at its Pape quarry near Gardners for use as an asphalt filler and for roofing.

Miscellaneous clay was produced from open pits by Gettysburg Drain Tile Works near Gettysburg for making drain tile and by Alwine Brick Co. near New Oxford for making building brick.

Allegheny.—Bituminous coal was produced at 42 operations (21 underground, 20 strip, and 1 auger). Production totaled 4.8 million tons, of which 88 percent was mined underground. Four million tons were not sold in the open market. Twenty-nine continuous-mining machines with 20 mobile loaders produced 2.9 million tons. Thirty-five cutting machines cut 1.35 million tons, and 37 mobile loading machines loaded 1.34 million tons. Strip mines reported 30 power shovels, 6 draglines, 23 bulldozers, 9 power drills, and 28 trucks or tractor-trailers. Seven preparation plants produced 3.6 million tons of clean coal, 58 percent by chance cones. Coal crushed totaled 3.2 million tons, and coal treated totaled 1.6 million tons.

Universal Atlas Cement, Division of United States Steel Corp., manufactured portland and masonry cements at its Universal plant using the dry process. Green Bag Cement Co., Division of Marquette Manufacturing Co., manufactured mostly slag portland cement and some masonry cement by the wet process at its Neville Island plant. Most of the finished cement was shipped to consumers intrastate and to Ohio and West Virginia.

Output of miscellaneous clay declined for the fifth consecutive year and was 68 percent below the 1957 output, when the county was the leading miscellaneous-clay-producing county in the State. Milliken Brick Co., Inc., mined clay from an open pit near Wilkinsburg and continued as the largest of five clay producers in the county. Smaller quantities of miscellaneous clay were recovered near Bridgeville, Creighton, McKeesport, and Murrysville. All of the clay production was used for building brick.

Sand and gravel was recovered by a dredge near Pittsburgh by Harry Zubik Co., Inc., for building and paving purposes. Sand for paving uses was produced by Burrell Construction & Supply Co. near Natrona Heights. Industrial sand and sand for construction purposes was produced by McCrady, Inc., near Harmarville and Sidwell Loam Sand Co. near Pittsburgh.

TABLE 11.—Value of mineral production in Pennsylvania by counties [1] [2]

County	1961	1962	Minerals produced in 1962 in order of value
Adams	(3)	(3)	Stone, sericite schist, clays.
Allegheny	(3)	(3)	Coal, cement, clays, sand and gravel, stone.
Armstrong	(3)	(3)	Coal, sand and gravel, clays, stone, lime.
Beaver	(3)	$3,866,842	Coal, clays, sand and gravel.
Bedford	[4] $1,693,450	2,288,829	Coal, stone, lime, sand and gravel.
Berks	[4] 24,872,370	34,655,423	Iron ore, cement, stone, clays, coal, pyrites, cobalt, sand and gravel.
Blair	[4] 1,877,511	2,160,807	Stone, coal, clays, sand and gravel.
Bradford	(3)	(3)	Sand and gravel.
Bucks	(3)	(3)	Sand and gravel, stone, clays.
Butler	[4] 14,221,736	16,034,719	Coal, cement, stone, lime, sand and gravel, clays.
Cambria	36,582,851	34,419,060	Coal, clays, sand and gravel, stone, iron ore (pigment material).
Cameron	197,349	(3)	Coal.
Carbon	(3)	(3)	Coal, stone, sand and gravel.
Centre	(3)	(3)	Lime, stone, coal, clays.
Chester	(3)	(3)	Stone, lime, clays, gem stones.
Clarion	11,623,425	13,627,949	Coal, stone, clays, sand and gravel.
Clearfield	27,959,810	27,139,085	Coal, clays.
Clinton	1,836,656	1,812,797	Coal, stone, clays.
Columbia	(3)	(3)	Coal, sand and gravel, clays.
Crawford	122,527	(3)	Sand and gravel.
Cumberland	(3)	(3)	Stone, sand and gravel, clays.
Dauphin	[4] 3,798,001	3,329,923	Stone, coal, clays, sand and gravel, lime.
Delaware	(3)	(3)	Stone.
Elk	1,407,929	1,783,675	Coal, clays, sand and gravel.
Erie	(3)	(3)	Sand and gravel, peat.
Fayette	(3)	(3)	Coal, stone, sand and gravel, clays.
Forest	(3)	(3)	Sand and gravel.
Franklin	(3)	(3)	Stone, sand and gravel.
Fulton	(3)	(3)	Do.
Greene	60,582,351	(3)	Coal, clays.
Huntingdon	3,796,577	(3)	Sand and gravel, stone, coal, clays.
Indiana	23,177,337	(3)	Coal, clays.
Jefferson	(3)	(3)	Coal, clays, sand and gravel.
Juniata	(3)	(3)	Stone, lime.
Lackawanna	(3)	(3)	Coal, sand and gravel, stone.
Lancaster	(3)	(3)	Stone, coal, sand and gravel, clays, lime, gem stones
Lawrence	(3)	(3)	Cement, stone, coal, clays, sand and gravel, peat.
Lebanon	(3)	(3)	Iron ore, stone, lime, copper, cobalt, pyrites, coal, gold silver.
Lehigh	(3)	(3)	Cement, zinc, stone, sand and gravel, gem stones.
Luzerne	(3)	(3)	Coal, stone, sand and gravel, peat, clays, gem stones.
Lycoming	1,759,556	1,530,655	Stone, sand and gravel, coal, tripoli.
McKean	371,979	211,590	Clays, sand and gravel.
Mercer	3,958,718	(3)	Coal, sand and gravel, stone.
Mifflin	(3)	1,989,202	Sand and gravel, stone, lime.
Monroe	(3)	1,049,520	Stone, sand and gravel, clays, peat, gem stones.
Montgomery	[4] 12,842,156	13,655,719	Stone, cement, lime, clays, sand and gravel, gem stones.
Montour	(3)	(3)	Stone, sand and gravel
Northampton	(3)	73,728,150	Cement, stone, sand and gravel, gem stones.
Northumberland	(3)	12,941,584	Coal, clays, stone, lime.
Perry	(3)	(3)	Stone.
Philadelphia	(3)	(3)	Sand and gravel.
Potter	(3)	205,132	Stone.
Schuylkill	55,035,930	50,085,171	Coal, stone, sand and gravel, clays.
Snyder	[4] 511,338	430,511	Stone, sand and gravel, coal, clays, lime.
Somerset	(3)	10,657,312	Coal, stone, clays, sand and gravel.
Sullivan	90,334	63,122	Coal.
Susquehanna	(3)	(3)	Stone, coal.
Tioga	1,340,683	(3)	Coal, stone.
Union	538,017	(3)	Stone.
Venango	2,222,660	(3)	Coal, sand and gravel.
Warren	(3)	226,253	Sand and gravel.
Washington	(3)	(3)	Coal, stone.
Wayne	340,653	474,698	Peat, stone, sand and gravel, coal.
Westmoreland	(3)	20,072,149	Coal, stone.
Wyoming	(3)	(3)	Sand and gravel, stone.
York	[4] 15,686,512	16,764,312	Cement, stone, lime, sand and gravel, clays, mica.
Undistributed	[4] 496,679,877	477,947,811	
Total	[4] 805,128,000	823,152,000	

[1] Pike County is not listed because no production was reported.
[2] Excludes value of production for LP gases, natural gasoline, petroleum, natural gas, and some gem stones and sand and gravel (1961) unspecified by counties; included with "Undistributed."
[3] Included with "Undistributed" to avoid disclosing individual company confidential data.
[4] Revised figure.

Malli Mines produced irregular-shaped sandstone for flagging and building stone near Finleyville. Nick Gioia produced rubble sandstone near Buena Vista.

Perlite Manufacturing Co., Carnegie, and Panacalite Perlite Co., Pittsburgh, expanded Colorado perlite, mainly for use in building plaster, loose-fill insulation, and concrete aggregate.

Armstrong.—Bituminous coal was produced at 102 operations (44 underground, 49 strip, and 9 auger). Production totaled 3.5 million tons, 1.9 million tons from underground, 1.5 million tons from strip mines, and 98,000 tons from auger mines. Most of the production, 3.4 million tons, was sold in the open market for an average price of $4.48 per ton. Of the 1.9 million tons produced underground, 73 cutting machines cut 1.7 million tons, 3 continuous mining machines and 1 mobile loader mined 222,000 tons, and 26 mobile loading machines loaded 1.5 million tons. Strip mines had 80 power shovels, 25 draglines, 4 carryall scrapers, 69 bulldozers, 17 power drills, and 143 trucks or tractor-trailers. Auger mines reported 9 augers, 1 bulldozer, 4 power drills, and 17 trucks or tractor-trailers. Eight preparation plants cleaned 1.6 million tons of coal, 63 percent by wet washing other than jigs. Coal crushed totaled 2.1 million tons, and coal treated totaled 91,000 tons.

Sand and gravel was recovered in large quantities by a marine dredge at Kittanning by Davison Sand & Gravel Co. and was used in ready-mixed concrete for building and paving purposes. Sand and gravel was also produced by Glacial Sand & Gravel Co. at Tarrtown, Manorville Sand Co. at Manorville, and John Cihat near Leechburg for construction purposes.

Plastic fire clay was produced at nine operations, six underground and three open pits. Freeport Brick Co. had the largest underground clay mine near Freeport. Other underground clay mines were located near Kittanning (two), New Bethlehem, Templeton, and Adrian. The three open-pit operations were located near Worthington, Craigsville, and Apollo. The plastic fire clay was used for firebrick and block, building brick, pouring pits, and other heavy clay products.

Beaver Run Limestone Co. produced crushed limestone near Apollo for concrete and roadstone. C.D. McCanna and Robert T. Toy produced limestone underground near Kittanning for the manufacture of quicklime in limekilns located at the mines. The quicklime was hydrated for agricultural use.

Beaver.—Bituminous coal was produced at 20 operations (1 underground, 16 strip, and 3 auger). Strip mines produced 587,000 tons and had 23 power shovels, 14 draglines, 20 bulldozers, 5 power drills, and 35 trucks or tractor-trailers. The underground operation reported two hand-loaded face conveyors and two cutting machines. Auger mines produced 42,000 tons and reported three augers, one power drill, and three trucks or tractor-trailers. No preparation plants were in operation, but 128,650 tons was crushed at loading tipples.

Plastic fire clay, produced at five operations, three underground mines near Beaver Falls, Fallston, and New Brighton and two open pits near Darlington, was used chiefly for building brick. Semiflint clay was produced near Darlington for building brick, and miscellaneous red clay was produced near New Brighton for pottery and flower pots.

Sand and gravel was recovered by Shippingport Sand & Gravel Co. near Shippingport and Iron City Sand & Gravel Corp. near Pittsburgh for building and paving purposes. Ellwood Stone Co. processed industrial sand for grinding and polishing, blast, fire, and engine uses near Ellwood City.

Central Commercial Co. produced artificially colored roofing granules at a plant near Darlington.

Bedford.—Bituminous coal was produced at 16 operations (14 underground and 2 strip). Underground mines produced 177,600 tons by 1 continuous miner, 6 hand-loaded face conveyors, and 2 cutting machines, with 87,960 tons of the total underground production shot from the solid and cut by hand. Strip mines reported 4 power shovels, 3 draglines, 4 bulldozers, 2 power drills, and 4 trucks or tractor-trailers. No preparation plants were reported in operation but some coal was crushed at loading tipples.

New Enterprise Stone & Lime Co. produced crushed limestone at its Ashcom quarry for concrete, roadstone, agricultural purposes, mine dust, and lime manufacture. Quicklime and hydrated lime were also manufactured at the Ashcom operation. Bedford County Stone & Lime Co. produced limestone near New Paris for concrete and roadstone. Sand was produced by Feight Brothers near Everett for building purposes.

Berks.—Bethlehem Cornwall Corp. continued to produce crude magnetite from its Grace underground mine near Morgantown by block caving and shrinkage stoping. The crude ore was processed in the company concentrator located at the mine by flotation and magnetic separation.

Allentown Portland Cement Co. quarried and crushed cement rock and limestone at two operations near Evansville and manufactured portland and masonry cement at its Evansville No. 1 plant. Finished cement was shipped mostly to ready-mixed concrete companies. Shipments and value of portland cement showed an increase over those of 1961. Eastern Lime Corp. quarried and crushed limestone at its Hinterleiters quarry, Kutztown, and Oley quarry, Oley, for concrete, roadstone, agricultural purposes, and cement manufacture. E. J. Breneman, Inc., produced crushed limestone near Sinking Spring and sold various sized stone to contractors for State and local government projects and to State and local governments. Berks Products Corp. produced crushed limestone near Temple for concrete and roadstone. Basalt, crushed chiefly for use as railroad ballast and road material was recovered from the Clingan quarry near Birdsboro by The John T. Dyer Quarry Co. Pottstown Trap Rock Quarries, Inc., Pottstown, and Bradford Hills Quarry, Inc., Morgantown, quarried diabase for use as concrete aggregate and roadstone. Reading Poultry Food Co., Reading, crushed oystershell for poultry grit and mineral food.

Production and value of anthracite decreased, compared with those of 1961.

Sand and gravel was produced by Schildt Bros. near Temple and by Grings Quarry near Sinking Spring for construction purposes. Industrial sand for fire or furnace use was produced near Pricetown by Refractory Sand Co., Inc.

Miscellaneous clay and shale was produced from two open pits near Wyomissing and Shoemakersville by Glen Gery Shale Brick Corp.

and used to manufacture building brick. Mineral specimens were collected near Lobachsville and Boyertown.

Blair.—Crushed limestone was produced at quarries near Hollidaysburg (three), Altoona, Claysburg, Royer, Duncansville, Roaring Springs, and Tyrone for concrete, roadstone, and agricultural purposes. General Refractories Co., Frankstown, and J. L. Hartman, Sproul, quarried and crushed quartzite for silica brick.

West Virginia Pulp & Paper Co. produced regenerated quicklime in secondary recovery operations for use in the manufacture of paper at its Tyrone and Williamsburg plants.

Bituminous coal was produced at four operations (three underground and one strip). Production totaled 78,400 tons of which 91 percent came from the strip mine. Underground mines had three hand-loaded face conveyors with all the coal shot from the solid and cut by hand. The strip mine reported 2 power shovels, 1 dragline, 2 bulldozers, and 10 trucks or tractor-trailers. No preparation plants were reported in operation, but a small tonnage was treated with coal spray.

Kaolin was produced from an open-pit mine by Grannas Brothers near Williamsburg and used to manufacture firebrick and block. Plastic fire clay was produced from the Butler open-pit mine of Harbison-Walker Refractories Co. near Hollidaysburg. Sand was produced by Frankstown Sand Co. at Frankstown and by Frankstown Sand Supply near Hollidaysburg for building purposes.

Bradford.—Sand and gravel was produced by Towanda Sand & Gravel Co., Inc., and J. A. Eck & Sons, Inc., near Towanda for building and paving purposes. Bituminous coal was produced at one strip operation reporting two power shovels, one dragline, and two trucks.

Bucks.—Sand and gravel was produced in large quantities at the Van Sciver plant of Warner Co. near Tullytown for building uses and ready-mixed concrete. Sand and gravel, primarily for building purposes, was produced by the following companies: Durnan & Good, Kintnersville; A. L. Lewis, New Hope; Amico Sand & Gravel Co., Morrisville; Frank Casillo & Sons, Inc., Upper Black Eddy; Silvi Concrete Products, Tullytown; and Penn Valley Crushed Stone Co., Levittown. Industrial sand for molding was produced near Tullytown by The Brennan Sand Co.

Crushed limestone for concrete and roadstone was produced by five companies operating quarries near New Hope, Buckingham, Trevose, Rushland, and Eureka. Some dimension building limestone was quarried near Trevose. Largest limestone producers were Eureka Stone Quarry, Inc., and New Hope Crushed Stone Lime Co. Samuel M. Yoder Estate operated the Blooming Glen quarry and crushing plant, producing bluestone and redstone; George Wiley operated Wiley's quarry near Point Pleasant, producing bluestone. Both companies quarried and crushed sandstone for concrete and roadstone. Some dimension sandstone was quarried near Lumberville and sold as irregularly-shaped construction stone. Five operators near Telford, Ottsville, Quakertown, Edison, and Weisel quarried and crushed diabase for concrete and roadstone. A quantity of dimension diabase for rough and dressed construction and dressed monumental stone was also produced. Crushed and broken miscellaneous stone (argil-

lite), sold or used as concrete aggregate and roadstone, was produced by Better Materials Corp., Penns Park.

Hyzer & Lewellen, Southampton, exfoliated crude vermiculite from Southern Rhodesia. The material was screened and sold as residential insulation and concrete and plaster aggregate. Miscellaneous clay was obtained from an open pit near Quakertown by Quakertown Brick & Tile Co., Inc., for the manufacture of building brick.

Butler.—Bituminous coal was produced at 64 operations (22 underground, 34 strip, and 8 auger). Production totaled 2.2 million tons, of which 83 percent came from strip mines. Underground operations had 29 cutting machines, 4 mobile loaders, 1 continuous miner, 2 self-loading conveyors, and 6 hand-loaded face conveyors. Strip mines reported 44 power shovels, 23 draglines, 48 bulldozers, 22 power drills, 128 trucks or tractor-trailers. Auger mines reported 8 augers, 1 bulldozer, 1 power drill, and 15 trucks or tractor-trailers. Two preparation plants were active, one using a jig and one using heavy media cleaning equipment. Coal crushed totaled 879,700 tons, and coal treated totaled 128,700 tons.

Penn-Dixie Cement Corp. produced crushed limestone and manufactured portland and masonry cement, using the wet process at its No. 9 plant near West Winfield. Finished cement was shipped mostly by truck, in bulk, to ready-mixed concrete companies.

Production of limestone, the only stone produced, increased 66 percent. Sechan Limestone Co., Prospect, and Allegheny Mineral Corp., Harrisville, produced crushed limestone for concrete and roadstone. Grove City Limestone Co., Branchton, and Winfield Lime & Stone Co., West Winfield, produced crushed limestone for concrete, roadstone, and agricultural purposes.

Quicklime and hydrated lime were produced by Mercer Lime & Stone Co. at its plant near Branchton and were sold for chemical and industrial uses. Some hydrated lime was sold for agricultural purposes. Sand and gravel for construction purposes was produced by H. W. Cooper, Slippery Rock, Penn-Dixie Cement Corp., Nazareth, and Highway Sand & Gravel Co., Inc., Slippery Rock. Scott Borland Brick Yard obtained miscellaneous clay and shale from a deposit near Mars for manufacturing building brick.

Cambria.—Bituminous coal was produced at 113 operations (91 underground, 19 strip, and 3 auger). Production from underground mines totaled 5.45 million tons, of which 4.26 million tons was mined by 85 continuous-mining machines. Additional underground mining equipment included 19 mobile loading machines, 40 hand-loaded face conveyors, 108 cutting machines, 205 shuttle cars, and 136 belt conveyors. Strip mines reported 42 power shovels, 16 draglines, 28 bulldozers, 9 power drills, and 47 trucks or tractor-trailers. Auger mines reported three augers and two trucks. Eleven preparation plants cleaned 4.6 million tons of underground coal by pneumatic methods and wet washing, other than jigs. Coal crushed totaled 2.6 million tons, and coal treated totaled 406,000 tons.

Harbison-Walker Refractories Co. abandoned the Frick underground fire-clay mine near Blandburg and used clay from stockpiles. Flint fire clay was mined underground near South Fork for sleeves, nozzles, and stoppers by Hiram Swank's Sons, Inc. Triangle Clay Products Co. produced miscellaneous clay for building brick and

installed new crushing facilities at its operation near Johnstown. Plastic fire clay was produced by George P. Gates from an underground mine near Patton for vitrified sewer pipe.

Sand and gravel was produced near Johnstown by Parry Sand & Gravel Co. for building and fill purposes.

Samuel Nicosia, Johnstown, produced and sold crushed sandstone for roadstone and making silica brick. Lanzendorfer Minerals Co. produced sulfur mud for iron oxide pigments at its No. 31 mine near Nanty Glo.

Cameron.—Bituminous coal was produced at one strip operation reporting four power shovels, one dragline, three bulldozers, one power drill, and seven trucks or tractor-trailers. The coal was cleaned at a preparation plant using heavy media cleaning equipment.

Carbon.—Anthracite from underground mines, strip pits, and culm banks totaled 674,000 tons, 22 percent more than in 1961. Fifty-six percent of the production was shipped by truck. Leading producers of anthracite were Greenwood Stripping Corp. and Sullivan Trail Coal Co.

Quartzite was produced at the Little Gap quarry and crushed for making silica brick at the Palmerton plant of North American Refractories. Crushed and broken sandstone used mainly for road material was quarried at the Red Rock quarry near Nesquehoning by James and Paul Fauzio.

Sand was produced near Palmerton by Alliance Sand Co. of Martin Marietta Corp. for building, paving, and cement manufacture. Sand and gravel was produced for building uses by Wagner Sand Co. near Hazelton.

Centre.—The county remained the leading lime-producing area. Three companies operated rotary kilns near Bellefonte. Quicklime and hydrated lime were marketed chiefly for chemical uses, but smaller quantities were sold for construction and agricultural purposes.

Six companies produced crushed limestone at operations near Bellefonte (three), State College (one), and Pleasant Gap (two). The crushed limestone was used primarily for lime manufacture, concrete, roadstone, glassmaking, flux, stone sand, and agricultural purposes.

Bituminous coal was produced at 28 operations (12 underground and 16 strip). Production totaled 729,000 tons, of which 96 percent came from strip mines reporting 40 power shovels, 19 draglines, 22 bulldozers, 14 power drills, and 85 trucks or tractor-trailers. Underground operations used five cutting machines and three hand-loaded face conveyors. One preparation plant cleaned 210,000 tons by wet washing using jigs and 56,500 tons by pneumatic methods. Coal crushed totaled 391,000 tons and coal treated totaled 50,000 tons.

Plastic fire clay was produced by Harbison-Walker Refractories Co. at its Blair open-pit mine.

Chester.—Bradford Hills Quarry, Inc., crushed a large amount of limestone at an operation near Downingtown for concrete and roadstone. The Warner Co. produced crushed limestone and dolomite near Devault primarily for its Cedar Hollow lime and magnesite plants, although sizable quantities of stone were used for flux, refractory, and agricultural purposes. Quicklime and hydrated lime were manufactured at the Cedar Hollow plant for construction, agricultural, and chemical uses. The Warner Co. also produced crushed limestone for

concrete and roadstone at its Johnson plant near Paoli. Valley Forge Stone Co. produced crushed limestone for concrete, roadstone, and riprap at an operation near Malvern.

Abram T. Minor, John Fecondo & Sons, and Albert Rotunno, all near Avondale, quarried dimension sandstone (bluestone) as irregularly-shaped construction stone, flagging, and rubble. Frank Rarick (formerly Bacton Hill Quarry) quarried dimension sandstone for use as irregularly-shaped construction stone and rubble near Malvern. Dimension stone (black diabase) dressed for use as architectural stone, monuments and mausoleums, and industrial surface plates, was quarried near Saint Peters. Crushed and broken diabase was quarried near Glenmoore and Devault for roadstone and railroad ballast.

McAvoy Vitrified Brick Co. produced miscellaneous clay and shale near Phoenixville for manufacturing building brick. Mineral specimens were collected near West Chester, Cornog, Coatesville, and Chester Springs.

Clarion.—Bituminous coal was produced at 48 operations (6 underground, 35 strip, and 7 auger). Production totaled 3.5 million tons, of which 98 percent came from strip mines reporting 82 power shovels, 48 draglines, 56 bulldozers, 12 power drills, and 153 trucks or tractor-trailers. Underground operations reported six cutting machines, one mobile loader, one continuous miner, and three handloaded face conveyors. Auger mines reported seven augers, one bulldozer, and six trucks or tractor-trailers. Seven preparation plants cleaned 1.7 million tons of strip coal, of which 731,600 tons was cleaned by wet washing using jigs, 753,400 tons by wet washing using heavy media, and 212,500 tons by pneumatic methods. Coal crushed totaled 2.5 million tons, and coal treated totaled 285,500 tons.

Limestone was quarried and crushed by Allegheny Mineral Corp. near Parker for road material and agricultural purposes and by Emlenton Limestone Co., Inc., near Turkey City for road material.

Plastic and flint fire clay was produced underground by A. P. Green Fire Brick Co. at its Climax operation for firebrick and block. Plastic fire clay was produced near New Bethlehem by Frank Pope Co. for mortar. Flint fire clay was produced for clay crucibles near Corsica by W. P. Stahlman Coal Co., Inc. Flint fire clay was mined underground at Lucinda for firebrick and block. New Bethlehem Tile Co. produced plastic fire clay and miscellaneous shale for building brick and structural clay tile near New Bethlehem. Glacial Sand & Gravel Co. processed sand and gravel for building, paving, and tile underdrain at its Parker plant.

Clearfield.—Bituminous coal was produced at 187 operations (73 underground, 104 strip, and 10 auger). Production totaled 6.6 million tons, of which 83 percent came from strip mines reporting 211 power shovels, 100 draglines, 2 carryall scrapers, 152 bulldozers, 66 power drills, and 376 trucks or tractor-trailers. Underground operations produced 1 million tons of coal using 103 cutting machines, 15 mobile loaders, 3 continuous miners, 11 self-loading conveyors, and 34 handloaded face conveyors. Auger mines reported 12 augers, 3 bulldozers, and 16 trucks or tractor-trailers. Seven preparation plants cleaned 1.3 million tons, 63 percent by pneumatic methods and the remainder by heavy media processes. Of the coal cleaned, 64 percent came from

strip mines and 36 percent from underground mines. Coal crushed totaled 2.7 million tons, and coal treated totaled 546,000 tons.

General Refractories Co. produced flint fire clay at 5 locations near West Decatur for firebrick and block. Harbison-Walker Refractories Co. reported plastic fire clay production for refractory products from 10 operations near Clearfield. Flint fire clay production only was reported at six operations for firebrick and block. Plastic fire clay production only was reported at nine operations for refractories or heavy clay products. Thomas Bros. Coal Co. near Curwensville was the leading producer of plastic fire clay. American Vitrified Products Co. manufactured vitrified sewer pipe from miscellaneous clay and shale produced near Clearfield.

Clinton.—Bituminous coal was produced at seven operations, one underground and six strip. Production totaled 406,700 tons, of which 404,700 tons came from strip mines reporting 13 power shovels, 4 draglines, 1 carryall scraper, 11 bulldozers, 2 power drills, and 12 trucks or tractor-trailers. The underground operation cut coal by hand and shot from the solid. One preparation plant cleaned 64,000 tons of strip coal using a heavy media washer. Coal crushed totaled 168,300 tons, and coal treated totaled 41,900 tons.

Crushed and sized limestone for concrete, roadstone, and railroad ballast was produced by Lycoming Silica Sand Co. near Salona. Miscellaneous clay and shale was mined under contract for Mill Hall Clay Products, Inc. and used in manufacturing heavy clay products. Flint diaspore and shaly iron type fire clay was produced from a deposit by Fink & Stackhouse near Lock Haven and sold for the manufacture of refractories.

Columbia.—Anthracite production totaled 388,000 tons, 19 percent below the 1961 output. Jeddo-Highland Coal Co. was the major producer. Bloomsburg Sand & Gravel Co. produced building sand and gravel at a pit and processing plant near Bloomsburg. Miscellaneous clay and shale was recovered from an open pit near Mifflinville by The Alliance Clay Product Co., on property leased from Lloyd E. Eister, and used for manufacturing building brick.

Crawford.—Sand and gravel was produced by Conneaut Lake Sand & Gravel for building, paving, and fill uses near Conneaut Lake; W. L. Dunn for paving purposes near Cochranton; and Hasbrouck Sand & Gravel for building and paving uses near Titusville.

Cumberland.—Crushed limestone for roads was produced by Hempt Bros., Inc., Eberly Mills, and Valley Quarries, Inc., Shippensburg. Locust Point Quarries, Mechanicsburg, quarried and crushed limestone for concrete, roadstone, and agricultural purposes. Sand and gravel production for building and paving was recorded at two operations, R. A. Bender & Son near Mt. Holly Springs and Hempt Bros. near Camp Hill. Sand for building purposes was produced by C. and L. Goodhart at Walnut Bottom. Cumberland County remained the leading kaolin-producing county. Kaolin was mined from the Toland open-pit mine near Mt. Holly Springs by Philadelphia Clay Co. and used almost entirely in making white cement. A small tonnage of kaolin was used in making colonial building bricks.

Dauphin.—Crushed limestone was produced at quarries near Steelton, Hummelstown, and Palmyra and was primarily used as blast-furnace and open-hearth flux, aggregate, and roadstone. Faylor Lime & Stone

Co., Elizabethville, produced crushed basalt (traprock) for road material. Production of anthracite totaled 143,000 tons; 61 percent was shipped by truck and the rest by rail. Leading producers included Gangloff Bros. and Elizabethville Coal Co.

Glen Gery Shale Brick Corp. used large amounts of miscellaneous clay and shale from its open pits near Harrisburg and Middletown for manufacturing building brick. Bethlehem Limestone Co. mined some miscellaneous clay and shale near Steelton for refractories and other uses. Sand and gravel was processed for building purposes by Pennsy Supply, Inc., at its Amity Hall plant near Duncannon. H. E. Millard Lime & Stone Co. manufactured hydrated lime for agricultural use at its Swatara plant near Annville.

Delaware.—Dimension sandstone for rough construction and rubble was quarried near Media by Media Quarry Co. Crushed granite (gneiss) for concrete and roadstone was quarried near Havertown and Glen Mills. Dimension granite was recovered at quarries near Lima and Swarthmore, for use as irregularly-shaped construction stone. Quarries in the central part of the county near Media, Springfield, and Marple Township, produced dimension miscellaneous stone (mica-schist) for rough and dressed structural stone and rubble.

Crude Colorado perlite was expanded at the Primos plant of Perlite Products Co. The expanded material was sold or used mainly as building plaster aggregate.

Sun Oil Co. recovered sulfur at its Marcus Hook refinery as a byproduct from the single-stage catalytic oxidation of hydrogen sulfide. Using the Claus-type process, Sinclair Refining Co. produced liquid sulfur as a byproduct in the liquid purification of oil refinery gas at its Marcus Hook refinery.

Elk.—Bituminous coal was produced at 25 operations (16 underground, 8 strip, and 1 auger). Production totaled 457,300 tons, of which 67 percent came from strip mines reporting 17 power shovels, 5 draglines, 1 carryall scraper, 7 bulldozers, 2 power drills, and 20 trucks or tractor-trailers. Underground operations used 31 cutting machines, 1 mobile loader, and 15 hand-loaded face conveyors. The auger mine reported 2 augers in its operation. One preparation plant cleaned coal for an underground mine. Coal crushed at loading tipples totaled 107,400 tons.

Plastic fire clay was produced at a strip mine near Weedville by E. M. Brown, Inc., and sold for manufacturing firebrick and block. Gravel was produced by Stone Haven Mix from a portable plant near Johnsonburg for use on roads by State and local highway crews.

Erie.—Erie Sand Steamship Co. near Erie produced over 1.1 million tons of sand by portable dredge and processed it for building and other uses. Sand and gravel for construction purposes was produced by A. Duchini Co., Erie, Nickel Plate Sand & Gravel Co., Fairview, and North Girard Concrete Works, Lake City. Industrial sand for molding was produced by Peerless Mineral Products Co. near Springfield.

Corry Peat Products Co. recovered reed-sedge and humus type peat from a bog near Corry. The output was sold in packages and in bulk.

Fayette.—Bituminous coal was produced at 56 operations (32 underground and 24 strip). Production totaled 1.3 million tons, of which

68 percent came from underground mines using 9 continuous miners, 6 mobile loaders, and 13 cutting machines with 68,800 tons being cut by hand and shot from the solid. Strip mining used 30 power shovels, 8 draglines, 23 bulldozers, 9 power drills, and 35 trucks or tractor-trailers. Five preparation plants cleaned 3.87 million tons of coal, using jigs, heavy media, and pneumatic cleaning equipment. Coal crushed totaled 871,800 tons.

Fry Coal & Stone Co., Division of Martin Marietta Corp., ground and sized limestone at the Lake Lynn quarry, Lake Lynn, and the Coolspring quarry, Uniontown. The stone was used for concrete, roadstone, rock dust, and agricultural purposes. General Refractories Co. crushed and ground ganister rock at its No. 2 Childs quarry for making silica brick. Connellsville Bluestone Co., Scottdale, quarried and crushed sandstone (bluestone) for road material. Some dimension sandstone was quarried for rubble near Connellsville by Andrew F. Kruczkiewicz. McClain Sand Co., Inc. produced 162,000 tons of sand and gravel for building and paving purposes near Point Marion.

Plastic and flint fire clay was produced at a strip pit near Ohiopyle by Kaiser Refractories & Chemicals Division of Kaiser Aluminum & Chemical Corp. for manufacturing firebrick and block. Robert N. Matthews produced and sold plastic and flint fire clay from Gettemy strip mine near Uniontown. Miscellaneous clay for manufacturing building brick was produced by Layton Fire Clay Co. at an open-pit operation near Layton. Harbison-Walker Refractories Co. produced some plastic fire clay near Ohiopyle at its Smith open-pit mine.

Forest.—Tionesta Sand & Gravel, Inc., prepared sand and gravel for construction at its stationary plant near Tionesta.

Franklin.—Production of stone totaled 782,000 tons, a 47-percent increase over that of 1961. Crushed limestone was used for concrete, roadstone, agricultural purposes, and railroad ballast. Limestone quarries were active near Dry Run, Williamson, Zullinger, Chambersburg, and Shippensburg. Pinola Lime & Stone Corp., Shippensburg, installed additional crushing equipment and storage bins to produce approximately 1,500 tons of limestone per day.

Caledonia Sand Co. and Mt. Cydonia Sand Co., Inc., mined sand from deposits near Fayetteville and processed it for building.

Fulton.—Crushed limestone was produced by H. B. Mellot Estate, Inc., at its Morton quarry, Big Cove Tannery, and Charlton quarry, Warfordsburg, for use as concrete aggrageate and roadstone. Mellot Sand processed sand near Warfordsburg for building and highway construction by contractors and other users.

Greene.—Bituminous coal was produced at 29 operations (22 underground and 7 strip). Production totaled 9.1 million tons, of which only 41,000 tons came from strip mines. Underground operations used 85 continuous miners with 21 mobile loaders to load 8.7 million tons of coal, 42 cutting machines to cut 371,600 tons and 29 mobile loaders to load 364,900 tons. Strip mines reported 9 power shovels, 1 dragline, 9 bulldozers, 3 vertical power drills, and 3 trucks or tractor-trailers. Six preparation plants cleaned 6.4 million tons of coal, 1 million tons by jigs and 5.4 million tons by heavy media, launders, hydroseparators, and duster tables. Coal crushed totaled 4.34 million tons.

Greene County Clay Products Co., Inc., used a small quantity of miscellaneous clay obtained from a nearby bank for the manufacture of building brick near Waynesburg.

Huntingdon.—Industrial sand, ground and unground, was produced by Pennsylvania Glass Sand Corp. at its Keystone works near Mapleton Depot. Most of the unground sand was used in manufacturing glass, and smaller tonnages were used for molding, blast, and engine purposes. Most of the ground sand was used in pottery, porcelain, and tile and for foundry uses; smaller tonnages were used for abrasives, chemical, enamel, filler, glass, binding products, and other purposes.

New Enterprise Stone & Lime Co. crushed limestone at its McConnellstown quarry for concrete aggregate and roadstone. The Warner Co., Union Furnace, quarried and crushed limestone for roadstone, riprap, and railroad ballast. Harbison-Walker Refractories Co., Mount Union, and North American Refractories Co., Three Springs, quarried and crushed ganister rock for making silica brick at local plants.

Bituminous coal was produced at seven operations (four underground and three strip). One cutting machine was used in underground operations. Strip mines reported four power shovels, two draglines, four bulldozers, two power drills, and five trucks or tractor-trailers. No preparation or crushing equipment was reported.

Plastic fire clay was produced and sold for making refractory mortar by Alexandria Fire Clay Co. near Alexandria.

Indiana.—Bituminous coal was produced at 95 operations (63 underground, 30 strip, and 2 auger). Production totaled 4.8 million tons, of which 87 percent came from underground operations. Of the total underground production, 2.9 million tons was produced by 36 continuous miners with 6 mobile loaders, 1.1 million tons was loaded by 29 mobile loaders, 1.3 million tons was cut by 73 cutting machines, 78,000 tons was hand-loaded onto 23 face conveyors, and 32,000 tons was loaded by 3 self-loading conveyors. Strip operations had 48 power shovels, 17 draglines, 1 carryall scraper, 51 bulldozers, 10 power drills, and 104 trucks or tractor-trailers. Ten preparation plants cleaned 3.9 million tons of coal, 3.2 million tons by heavy media, chance cones, diester tables, hydrotator, and froth flotation equipment, and the remaining tonnage by jigs and pneumatic equipment. Coal crushed totaled 1.5 million tons, and coal treated totaled 230,000 tons.

Plastic fire clay produced at the L. H. Foehrenbach strip mine near Clymer was sold and used to manufacture refractories.

Jefferson.—Bituminous coal was produced at 56 operations (24 underground, 27 strip, and 5 auger). Production totaled 1.38 million tons, of which 69 percent came from strip mines that had 56 power shovels, 17 draglines, 45 bulldozers, 4 power drills, and 69 trucks or tractor-trailers. Underground mines reported 39 cutting machines, 2 continuous miners, 5 self-loading conveyors, and 20 hand-loaded face conveyors. Auger mines reported six augers, one bulldozer, and three trucks. One preparation plant cleaned 208,900 tons of strip coal by jigs and pneumatic equipment. Coal crushed totaled 803,300 tons, and coal treated totaled 40,800 tons.

Plastic fire clay was produced by The Brockway Clay Co. at its underground and open-pit mines near Brockway for the manufacture of vitrified sewer pipe. Plastic fire clay was also produced from an underground mine at Summerville by Hanley Co. for the manufacture of building brick and other heavy clay products. Henry O'Neill & Co. produced and sold flint fire clay from an underground operation near Brookville.

Gravel was recovered near Brockway by Brockway Sand & Gravel and sold unprocessed for use as paving material.

Juniata.—Limestone was quarried near Mifflintown by Juniata Limestone Co., for concrete, agricultural purposes, cement manufacture, and roadstone. Fulkroad Lime Quarry, McAlisterville, produced limestone to manufacture quicklime for agricultural purposes. Kaiser Aluminum & Chemical Corp. produced crushed quartzite for making silica brick at its Van Dyke plant near Thompsontown but operations were discontinued in May.

Lackawanna.—Total production and value of anthracite declined slightly. Carbondale Coal Co. and Moffat Coal Co., Inc., were leading anthracite producers.

Sand and gravel for ready-mixed concrete and building and paving purposes was produced by Contractors Sand & Gravel, Inc., near Moscow. Scranton Sand & Stone Co., Gouldsboro, and The East Lemon Sand & Gravel Co., Dunmore, produced sand and gravel for paving purposes.

Crushed sandstone was produced at the West Mountain quarry near Scranton by Stabler Construction Co. Most of the production was sold to the Pennsylvania Department of Highways for road construction.

Lancaster.—Crushed limestone production totaled 3,121,000 tons from quarries located near Ephrata, East Petersburg, Blue Ball, Denver, Rheems, Talmage, Lititz, Landisville, Gap, Bainbridge, Paradise, Silver Springs, and Quarryville. The leading producer was D. M. Stoltzfus & Son, Inc., with quarries at Talmage and Quarryville. Most of the crushed limestone was used for concrete and roadstone, and smaller quantities were used for lime manufacture, agricultural purposes, asphalt filler, stone sand, refractory material, mineral food, and poultry grit.

Anthracite was produced by dredging operations in the Susquehanna River and production increased slightly from 1961.

Ephrata Sand & Gravel Co., Brownstown, produced sand for concrete and black top and gravel for road base. Hempt Bros., Elizabethtown, and Milton Grove Sand, Inc., Milton Grove, continued to process sand for construction purposes. Industrial sand was processed near Honeybrook by George F. Pettinos, Inc., for furnace use.

Miscellaneous clay and shale was produced at openpit operations of Glen Gery Shale Brick Corp. near Ephrata and Lancaster Brick Co. near Lancaster for the manufacture of building brick. Plastic fire clay was produced near Narvon by Narvon Mines, Ltd., and sold for use in foundries, rubber, insecticides, and fungicides and for building brick. Amos K. Stoltzfus manufactured quicklime for agricultural purposes near Elverson. Fluorite specimens were collected near Blue Ball.

Lawrence.—Portland and masonry cements were manufactured at the Bessemer plant of Bessemer Cement Co., Division of Diamond Alkali Co., using the wet process. Medusa Portland Cement Co. produced portland and masonry cements at its Wampum plant, using the dry process. Bulk shipments by truck to ready-mix concrete companies and highway contractors in Pennsylvania and Ohio comprised a major portion of the sales. Limestone production totaled 2.5 million tons. Medusa Portland Cement Co. produced limestone near Wampum, solely for cement manufacture. Michigan Limestone, Division of United States Steel Corp., produced limestone near Hillsville for blast-furnace flux and cement manufacture. Bessemer Cement Co., Division of Diamond Alkali Co., produced limestone near Bessemer for cement manufacture, blast-furnace flux, and roadstone. Calcite Quarry Corp., produced limestone near Lebanon for concrete, roadstone, cement manufacture, metallurgical flux, agricultural purposes, railroad ballast, and lime manufacture. New Castle Lime & Stone Co. produced limestone near Lowellville for concrete, roadstone, paint filler, asphalt and roofing paper filler, dust for coal mines, and agricultural purposes. Mooney Bros. produced limestone near West Pittsburg for concrete and roadstone.

Bituminous coal was produced at 25 operations (1 underground, 21 strip, and 3 auger). Strip mines produced 603,600 tons operating 32 power shovels, 21 draglines, 20 bulldozers, 4 power drills, and 25 trucks or tractor-trailers. All the coal at the underground operation was cut by one machine and hand-loaded onto a face conveyor. Coal crushed totaled 9,800 tons. None of the coal production was mechanically cleaned.

Lawrence County ranked first in total clay production. Plastic fire clay produced by Ralph A. Veon, Inc., was used to manufacture refractories and heavy clay products. Plastic fire clay was also produced near Enon Valley by Natco Corp. and The Negley Fire Clay Co. Metropolitan Brick, Inc., produced both plastic fire clay and miscellaneous clay for making building brick on properties leased near Bessemer. The Bessemer Cement Co., Division of Diamond Alkali Co., produced miscellaneous clay and shale for manufacturing portland and other hydraulic cements near Bessemer. Keystone Loam & Clay Co. sold miscellaneous clay near Edinburg for use in foundries and steelworks. Fenati Brick Co., Inc. produced miscellaneous clay and shale from an open pit near New Castle for use in its building brick plant.

Superior Sand & Supply Co. and Mooney Bros. Supply Co. processed sand and gravel for building, paving, and fill purposes. Mahoning Valley Sand Co. processed sand and gravel for construction purposes and a small quantity of industrial sand for foundry purposes near West Pittsburgh.

D. M. Boyd produced reed-sedge and humus peat from bogs near New Wilmington. Moore's Humus & Nursery recovered humus peat from bogs near Washington Township. Both companies sold their output in bulk.

Crude vermiculite shipped from Montana and South Carolina, was exfoliated by Zonolite Co. at its Elwood City plant.

Lebanon.—Bethlehem Cornwall Corp. produced crude magnetite from underground operations at Cornwall by the block-caving method.

The crude ore was processed in the new Cornwall concentrator by crushing and grinding, magnetic separation, flotation, and agglomeration, yielding iron ore pellets, iron ore concentrates, copper concentrates containing silver and gold, and pyrite concentrates containing cobalt.

Limestone production totaled 1,359,000 tons, an increase of 5 percent over that of 1961. H. E. Millard Lime & Stone Co. produced over half of the total limestone production near Annville for cement manufacture, concrete, roadstone, railroad ballast, agricultural purposes, and its own lime manufacture. The company operated 4 rotary kilns to produce quicklime and hydrated lime at its Annville plant. The lime was used chiefly for metallurgy, construction, water purification, papermaking, and agricultural purposes. Fiala, Inc., produced limestone near Annville for cement manufacture and metallurgical flux. Limestone for concrete and roadstone was produced by Pennsylvania Aggregates, Inc., near Cornwall.

Anthracite production increased from that of 1961.

Lehigh.—Production of limestone totaled 2,477,000 tons, an increase of 15 percent over 1961 output. Coplay Cement Manufacturing Co., Coplay, The Whitehall Cement Manufacturing Co., Cementon, Lehigh Portland Cement Co., Fogelsville, and Giant Portland Cement Co., Egypt, quarried and crushed limestone for manufacturing portland and masonry cements at local plants. Major shipments of cement were by railroad, mostly in bulk, to ready-mixed concrete companies in Pennsylvania, New Jersey, and New York. Lehigh Stone Co., Ormrod, Roy J. Kern, Schnecksville, and Eastern Lime Corp., West Coplay, quarried and crushed limestone for concrete and roadstone. Penn Big Bed Slate Co., Inc., processed slate at its No. 2 quarry near Slatedale chiefly for structural and sanitary uses, blackboards, bulletin boards, and standard roofing slate. Crude perlite, mined in Colorado, was expanded by Pennsylvania Perlite Corp. at its Allentown plant, primarily for use as building plaster aggregate.

The New Jersey Zinc Co. produced crude zinc ore from its Friedensville underground mine by the room and pillar method. The crude ore was processed and shipped by truck to the company smelter at Palmerton. Jasper, corundum, and quartz crystals were found in the county by gem and mineral collectors.

Luzerne.—The county ranked second in production of anthracite. Average value decreased from $9.18 per ton in 1961 to $8.41. Leading producers were Glen Alden Corp., Lehigh Valley Anthracite, Inc., and Jeddo-Highland Coal Co.

Luzerne County ranked second in production of sandstone; total output was 328,000 tons. Sandstone was produced at quarries near White Haven, Dupont, and Trucksville. Coolbaugh Sand & Stone Co., Inc., Dupont, installed two crushers to increase capacity and versatility at its plant.

Luzerne County was the leading sand and gravel producing area in northeastern Pennsylvania. Largest producers were Airport Sand & Gravel Co. Inc., Wyoming, and Frank B. Sgarlat Sand & Gravel Co., Forty Fort. Other sand and gravel operations were located at Hazleton, Drums, Avoca, and Nescopeck. All sand and gravel was used for construction.

Blue Ridge Soil Pep Co., Inc., recovered humus peat from a bog near White Haven. Pennsylvania Peat Moss, Inc., produced moss, reed-sedge, and humus peat from bogs near White Haven.

Miscellaneous clay and shale for building brick was mined by Hazleton Brick Co. near Hazleton. Quartz crystals were collected as mineral specimens.

Lycoming.—Lycoming Silica Sand Co. produced crushed limestone from the Lime Bluff quarry, Muncy, and the Pine Creek quarry, Jersey Shore, principally for concrete and roadstone. In addition, crushed limestone for agricultural purposes was produced at the Pine Creek quarry. Limestone was quarried solely for roadstone near Jersey Shore by Susquehanna Quarry Co. Haines Stone Co., Slate Run, produced dimension sandstone for flagging stone and rubble. Some ground slate was produced near Muncy.

Lycoming Silica Sand Co. processed sand and gravel for construction and industrial sand for molding, engine, and other uses near Montoursville.

Bituminous coal was produced at four operations (one underground and three strips). The underground mine reported 1,440 tons cut by hand and shot from the solid. Strip mines had 3 power shovels, 2 draglines, 3 bulldozers, 2 power drills, and 13 trucks. None of the coal produced was mechanically cleaned, but 31,960 tons was crushed at a loading tipple.

Tripoli (rottenstone) was quarried by Penn Paint & Filler Co., Antes Fort, and Keystone Filler & Manufacturing Co., Muncy. The crude material was crushed, dried, and ground for use as an abrasive filler.

McKean.—Plastic and burley fire clays were produced by Kness Brothers Producers near Mt. Jewett for manufacturing foundry refractories. Miscellaneous clay was recovered from an open pit at Lewis Run by Hanley Co. and used in a local plant for making building brick. A small quantity was sold for other uses. Industrial sand for blast purposes was produced by C. L. McGavern, Jr. near Eldred.

Mercer.—Bituminous coal was produced at 12 operations (1 underground and 11 strip). Production totaled 1.1 million tons, almost entirely from strip mines. The underground mine reported that all its tonnage was cut by two machines. The strip mines reported 19 power shovels, 14 draglines, 2 carryall scrapers, 16 bulldozers, 8 power drills, and 29 trucks or tractor-trailers. One preparation plant was active and used pneumatic equipment. Coal crushed totaled 433,800 tons, and some coal was treated with oil.

Sand and gravel for ready-mixed concrete and other construction uses was produced by Taylor Sand & Gravel Co. near Sharon. Other sand and gravel producers were Seidle Sand & Gravel Co., Mercer, and Transfer Sand & Gravel, South Pymatuning Township. Whitrock Silica Sand Co., quarried and crushed sandstone near Greenville for roadstone, furnace lining, riprap, abrasives, filler, play sand, and foundry uses.

Mifflin.—The Pennsylvania Glass Sand Corp. processed industrial sand near McVeytown for a variety of uses. Miller Silica Sand Co. processed sand for construction and industrial use near Burnham. George E. Miller Coal Co. processed sand and gravel near McVeytown

for building and paving. Sand for building was produced by James R. Klines' Sons near Lewistown.

Bethlehem Limestone Co. produced crushed limestone at its Naginey quarry near Milroy for blast-furnace flux, concrete aggregate, roadstone, and stone sand. George E. Miller Coal Co., Lewistown, produced limestone for concrete and roadstone. Honey Creek Lime Co., Reedsville, and Ehrenzeller Lime Co., McVeytown, produced crushed limestone for manufacturing lime. Ehrenzeller Lime Co. manufactured quicklime for agricultural purposes at its seven-draw-kiln plant near McVeytown. Honey Creek Lime Co. produced hydrated lime for agricultural purposes at its continuous hydrating plant near Reedsville. Quartzite was crushed and ground for making silica brick at the local plant of Haws Refractories Co. near Hawstone.

Monroe.—Limestone was produced by Hamilton Stone Co., Inc., at quarries near Saylorsburg and Stroudsburg for concrete, roadstone, and to a smaller extent for cement manufacture.

Javelyn Mobile Mix, Inc., acquired the sand and gravel business of Steward and Clyde White near Stroudsburg and processed the material for building purposes. Sheesley Minerals, Inc., produced sand near Kunkletown for use in concrete.

Universal Atlas Cement Division of United States Steel Corp. produced white clay near Kunkletown for use at its portland cement plant.

Humus peat was produced near East Stroudsburg by Pocono Peat Co. and sold in bulk. Fossil coral was collected as specimens near Stroudsburg.

Montgomery.—Production of stone in Montgomery County exceeded 4 million tons. Tonnage and value increased slightly, and the county continued to rank second in stone production. Two operators near Conshohocken and Norristown produced crushed limestone for concrete and roadstone. Quarries near Plymouth Meeting and Bridgeport produced crushed limestone principally for blast-furnace and open-hearth flux, concrete, roadstone, lime manufacture, and stone sand. Limestone quarried and crushed near West Conshohocken was used for manufacturing cement. Sixty-four percent of the limestone was transported by truck.

Dimension sandstone, for use as irregularly-shaped stone and rubble, was quarried near Norristown and Laverock. Fire Stone Products Co., Glenside, quarried dimension quartzite for use as linings (without further processing) in steel furnaces, and rubble. Basalt was crushed at quarries near Pottstown and Perkiomenville for concrete and roadstone. Montgomery Stone Co., Montgomeryville, produced dimension basalt for rough and dressed building stone and crushed basalt for roadstone. Gill Quarries, Inc., Norristown and Spring House, and M & M Stone Co., Harleysville, quarried a miscellaneous stone, argillite, solely for road material. A. Manero & Sons, Glenside, produced a miscellaneous dimension stone, mica-schist, for use as rough and dressed building stone. Granite was quarried near Bethayres for dressed stone, rubble, and crushed roadstone. Some dimension granite for use as rough building stone was quarried near Laverock.

Allentown Portland Cement Co. continued to operate its West Conshohocken No. 2 plant to manufacture portland and some masonry

cements. Finished cement was shipped to consumers mainly in bulk by railroad. G. & W. H. Corson, Inc., Plymouth Meeting, produced hydrated lime for construction, chemical, industrial and agricultural purposes.

Miscellaneous clay was produced by The Keller-Pottery Co. near North Wales for manufacturing flower pots. Plastic fire clay and shale was mined near Pottstown by Robinson Clay Product Co., to make vitrified sewer pipe. Miscellaneous clay and shale was produced near Norristown by Norristown Brick Co. for making building brick and near Trappe by Philadelphia Brick Co. for making flue and field title.

Sand for building purposes was processed by William Bambi & Sons, Inc., near Norristown. Refractory & Insulation Corp., Port Kennedy, and The Philip Carey Manufacturing Co., Plymouth Meeting, expanded perlite, shipped from Colorado, for insulation purposes.

Gem and mineral specimens collected included stilbite, natrolite, malachite, galena, zeolites, and quartz crystals.

Montour.—Limestone was quarried near Danville by Mausdale Quarry Co., for concrete aggregate and roadstone. Crushed and sized limestone was produced at a quarry near Milton by Lycoming Silica Sand Co. for roads and agriculture. A small quantity of sand and gravel was produced for building purposes by Thomas Sand & Gravel Co. near Danville.

Northampton.—The county led in total value of mineral output in the State, and cement was the major commodity produced. Value of cement shipments increased by 4 percent. Nine companies operated 11 plants and manufactured cement from captive limestone and purchased materials. Portland and masonry cements were produced. Most of the cement was shipped by rail, in bulk, to ready-mixed concrete companies and manufacturers of concrete products. Cement plants were located near Nazareth, Bath, Martins Creek, Northampton, Stockertown, and Bethlehem.

Northhampton County continued to rank first in stone production with a total output exceeding 5 million tons. Eleven firms produced limestone from quarries near Nazareth (four), Bethlehem (two), Northampton (two), Bath, Martins Creek, and Stockertown. Most of the captive limestone was utilized at company plants for manufacturing cement, but some was also used for concrete, roadstone, riprap, stone sand, agriculture, and railroad ballast. Northampton County was again the principal source of slate. Production increased 12 percent over that of 1961. Slate was recovered from nine operations at Pen Argyle (six), Bangor, East Bangor, and Bath. The processed slate was used principally for flagging stone, standard roofing, and structural and sanitary ware.

Consumers of sand and gravel for building and paving purposes were supplied by Houdaille Construction Materials, Inc., Portland; W. J. Lowe & Sons, Inc., Bangor; and Lehigh Valley Sand & Gravel Co., Inc., Easton. Some gem and mineral specimens were collected near Easton.

Northumberland.—Anthracite production totaled 1.6 million tons, a decrease of 15 percent from that of 1961. Average value per ton increased from $6.57 in 1961 to $7.54. Leading producers were Gap-Anthracite Co. and Reading Anthracite Co.

Watsontown Mineral Products Co. processed shale from stock for use as linoleum filler. Watsontown Brick Co. and Glen Gery Shale Brick Corp. produced miscellaneous clay and shale near Watsontown for the manufacture of building brick.

Limestone was quarried and crushed near Herndon for roadstone and agricultural use, and near Sunbury for lime manufacture. Clyde Starook, manufactured quicklime for agricultural purposes near Sunbury.

Perry.—Bradford Hills Quarry, Inc., quarried and crushed limestone at its Newport plant for concrete, roadstone, and screenings. Most of the stone was sold to the Pennsylvania Department of Highways and local townships for road construction.

Philadelphia.—The Liberty Corp. recovered sand and gravel for building material from a dredge along the Delaware River.

Atlantic Refining Co. recovered hydrogen sulfide by the Girdler system, using diethanolamine and monethanolamine. Gulf Oil Corp. recovered sulfur as a byproduct in the liquid purification of oil refinery gas by the Claus process.

Potter.—Dimension sandstone was produced from seven quarries near Austin, Oswayo, Wharton, and Roulette for flagging and other purposes.

Schuylkill.—The county ranked first in anthracite production, accounting for 37 percent of the total tonnage. Underground mines, strip pits, and culm banks were operated during 1962. Leading producers were Reading Anthracite Co., Greenwood Stripping Corp., Honeybrook Mines, Inc., and Gilberton Coal Co.

Huss Contracting Co., Andreas, and Pennsylvania Aggregates, Inc., Summit Station, quarried and crushed limestone for use as roadstone. Harbison-Walker Refractories Co. quarried and crushed quartzite at its Andreas quarry for use in manufacturing silica brick. Industrial sand for furnace use and sand for paving purposes was processed by Refractory Sand Co., Inc., near Andreas. Schuylkill County continued to be the leading miscellaneous clay producing county. Various producers supplied the Lehigh Materials Co. with shale for use in its lightweight aggregate plant. Auburn Brick Co. used its entire output of miscellaneous clay and shale to manufacture building brick near Auburn.

Snyder.—Limestone for concrete, roadstone, and riprap was quarried and crushed near Middleburg by National Limestone Quarry. Crushed limestone solely for lime manufacture was quarried by Carton L. Comfort near Mount Pleasant Mills. Quicklime for agricultural purposes was manufactured at the six-pot-kiln lime plant. Sand and gravel for building and paving was processed by Central Builders Supply Co. near Sunbury. Paxton Brick Co. used miscellaneous clay and shale mined from an open pit near Paxtonville for manufacturing building brick.

Production of anthracite from dredging operations in the Susquehanna River continued to decline.

Somerset.—Bituminous coal was produced at 117 operations (81 underground, 35 strip, and 1 auger). Production totaled 2.4 million tons. Underground operations reported 6 continuous miners, 1 mobile loader, 2 self-loading conveyors, 53 hand-loaded face conveyors, and 94 cutting machines. A total of 88,400 tons was cut by hand and shot

from the solid underground. Strip mines reported 62 power shovels, 36 draglines, 67 bulldozers, 21 power drills, and 138 trucks or tractor-trailers. Four preparation plants were active and cleaned 277,400 tons of coal using jigs, chance cones, heavy media, and pneumatic equipment. Coal crushed totaled 1.1 million tons, and coal treated totaled 127,300 tons.

Somerset Limestone Co., Inc., Bakersville, quarried and crushed limestone for concrete and roadstone. Keystone Lime Co., Springs, quarried and crushed limestone for roadstone and for agriculture. Crushed sandstone for concrete and roadstone was quarried near Springs by Rodamer Concrete Products.

Flint fire clay for the manufacture of firebrick and block was produced at three open-pit operations of General Refractories Co. near Rockwood and Fort Hill. Plastic fire clay was produced near Springs by Otto Brick & Tile Works for making building brick and from an underground mine near Hollsopple by Hiram Swank's Sons, Inc., for refractories. Sand for general purposes was recovered near Boswell by Robert Shaulis and Boswell Sand Co.

Sullivan.—Anthracite was produced by Bliss Coal Co. at an underground and strip mine and by E & B Coal Sales at a strip mine.

Susquehanna.—Dimension sandstone (bluestone) quarries, mostly for flagging were operated near Harford, Springville, Fort Washington, and Kingsley. Crushed sandstone for road material was recovered near Clifford by Keelor Supply Co., Inc. Susquehanna Quarry Co., a new producer near Montrose, produced crushed sandstone for road material. Anthracite was produced at the Forest City bank by Matisko Coal Co. and prepared at the Waddell Breaker.

Tioga.—Bituminous coal was produced at six operations (one underground and five strip). The underground mine produced 9,960 tons of coal by hand methods using two drills. The strip mines had 17 power shovels, 8 draglines, 14 bulldozers, 3 power drills, and 12 trucks or tractor-trailers. None of the production was cleaned mechanically, but 209,450 tons were crushed. Dimension sandstone was produced by Lyle R. Robinson in Elk Township, mainly for flagging.

Union.—Faylor Lime & Stone Co. produced crushed limestone near Winfield for concrete, roadstone, and agriculture. John L. Iddings produced crushed limestone near Mifflinburg for concrete and roadstone.

Venango.—Bituminous coal was produced at six strip operations. Production totaled 295,370 tons. Equipment used included 10 power shovels, 4 draglines, 1 carryall scraper, 12 bulldozers, 3 vertical power drills, and 5 trucks or tractor-trailers. A small quantity of coal was cleaned in a nearby county. No preparation facilities were active.

Industrial sand was produced near Utica by Pennsylvania Glass Sand Corp. for molding and furnace uses. Oil City Sand & Gravel Co., Oil City, reported output of sand and gravel for construction. Bank-run gravel production was reported by White City Sand & Gravel Near Titusville. Mrs. Ralph Vincent produced gravel, processed and bank-run, at Franklin for construction.

Warren.—General Concrete Products Corp. prepared sand and gravel for construction and industrial sand for smelting uses from a dredge along the Allegheny River near Warren. Sand and gravel also was

processed by Warren Sand & Gravel Co., Inc., Oil City, and by Nelson & Ellberg, Warren, for construction.

Washington.—Bituminous coal was produced at 39 operations (19 underground, 18 strip, and 2 auger). Production totaled 10.9 million tons, of which 92 percent came from underground mines. Washington County led other coal-producing counties in total coal produced and total underground coal produced. Underground mines produced 7.2 million tons using 72 continuous miners with 10 mobile loaders and 2.8 million tons using 69 mobile loaders. Forty-five cutting machines cut 2.8 million tons of coal. Strip mines had 31 power shovels, 8 draglines, 4 carryall scrapers, 29 bulldozers, 17 power drills, and 64 trucks or tractor-trailers. Auger operations reported two augers and one bulldozer. Nine preparation plants cleaned 8.3 million tons of coal, 2.4 million tons by jigs and 5.9 million tons by wet washing other than jigs. Coal crushed totaled 5.3 million tons, and coal treated with oil totaled 962,200 tons.

Limestone was quarried near Washington by Washington Stone Co. for concrete and roadstone. Fry Coal & Stone Co., Division of Martin Marietta Corp., operated a sandstone quarry and portable plant near Claysville for concrete aggregate and roadstone.

Wayne.—The county led in peat production which increased 20 percent over that of 1961. Reed-sedge and humus peat was recovered from bogs near Gouldsboro by Wayne Peat Humus Co.

Sandstone was quarried and crushed near Lake Ariel by Wayne Concrete & Sand Works, Inc., for concrete aggregate and roadstone. W. R. Strong & Son produced dimension sandstone for flagging and rubble. Sand and gravel was produced by Keystone Pavement & Construction Co., Inc., Lake Ariel, for black top paving uses, and by Willis R. Black, Lake Ariel, for farmers' building or repairing and to cover the township dump.

A small quantity of anthracite was recovered by strip mining. Masters Contracting Corp. operated the Browndale strip prepared the coal at Bolands breaker.

Westmoreland.—Bituminous coal was produced at 67 operations (42 underground, 24 strip, and 1 auger). Underground production totaled 3.4 million tons using 22 continuous miners with 15 mobile loaders, 28 mobile loaders, 7 hand-loaded face conveyors, and 46 cutting machines. Strip production totaled 161,000 tons and reported 31 power shovels, 7 draglines, 3 carryall scrapers, 29 bulldozers, 5 power drills, and 9 trucks or tractor-trailers. Seven preparation plants were active and cleaned 2.8 million tons of coal by jigs, other wet washing methods, and pneumatic methods. Coal crushed totaled 2.4 million tons, and coal treated totaled 1 million tons.

Limestone was quarried and crushed by Reischneider Bros., Lower Burrell, and Penn Aggregates, Jeannette, for roadstone. Westmoreland County continued to lead in the production of sandstone. Lynns Quarry, Belle Vernon, produced dimension sandstone for flagging. John C. Beaumont, Belle Vernon, produced dimension stone for rubble. Sandstone quarries were operated near Lycippus, Murrysville, and Baggaley for concrete and roadstone material. Latrobe Construction Co., Ligonier, operated an underground sandstone mine for roadstone. The company installed a new ventilating system.

Wyoming.—Sand and gravel was recovered by East Falls Sand &

Gravel, Falls, for building and paving. Wyoming Sand & Stone Co., Falls, produced sand and gravel for building and paving and industrial sand for engine use. J. G. Robinson, Inc., Fort Washington, produced dimension sandstone for flagging.

York.—Medusa Portland Cement Co., York, quarried and crushed limestone for manufacturing waterproof white and gray portland cements and some masonry cement, using the dry process. New facilities, costing $7 million, were being constructed at the York white cement plant of Medusa Portland Cement Co. and included a 450-foot-long rotary kiln, concrete storage silo, kiln feed tank, grinding mill, and burner buildings. When placed in operation, the new plant would approximately double the present productivity capacity. The original installation, built in 1907, was claimed to have been the first white cement plant in the world. J. E. Baker Co. manufactured dead-burned dolomite for refractory use at its York plant from dolomite the company quarried nearby. The stone was also sold for roadstone and agricultural use.

Limestone was quarried by Lincoln Stone, Inc., Thomasville, for roadstone and railroad ballast; York Stone & Supply Co., York, for roadstone and asphalt filler; Thomasville Stone & Lime Co., Thomasville, for metallurgical flux, cement, agriculture, glass, whiting, miscellaneous fillers, mineral food, and roadstone; National Gypsum Co., York, for floor covering, agricuture, roadstone, and metallurgical flux; White Pigment Corp., York, for miscellaneous chemical uses and fillers for paint, putty, rubber, carpets, abrasives, asbestos, caulking, ceramics, crayons, and gypsum board; and Standard Concrete Products Co., Inc., York, Klines Quarry, Inc., Wrightsville, and Cordorus Stone & Supply Co., Inc., Emigsville, for roadstone. Slate was crushed and ground for roofing granules near Delta by The Ruberoid Co.

Sand and gravel was produced by Pennsy Supply, Inc., York Haven, and Sherrill Sand Co., Mount Wolf, for construction. Neuman Sand & Supply Co. processed sand for brick facing and building near York.

Medusa Portland Cement Co. produced miscellaneous clay and shale near York for manufacturing portland and other hydraulic cements. Glen Gery Shale Brick Corp. produced miscellaneous clay and shale near York for manufacturing building brick.

General Mining Associates, Glenville, remained the only mica producer in the State. The scrap mica was processed by drying and air separation and was sold for use in paints, rubber, plastics, and welding rods. Pennsylvania Perlite Corp., York, expanded crude perlite, shipped from Colorado, mainly for use as building plaster aggregate.

The Mineral Industry of Puerto Rico, the Panama Canal Zone, the Virgin Islands, and Pacific Island Possessions

The Puerto Rico section of this chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Mineralogy and Geology Section, Industrial Research, Economic Development Administration, Commonwealth of Puerto Rico for collectiong information on all minerals except fuels.

By Harry F. Robertson,[1] José F. Cadilla,[2] Leovigildo Vázquez,[3] and Roy Y. Ashizawa[4]

PUERTO RICO

MINERAL production in Puerto Rico was valued at a record $38.5 million, about 11 percent above that of 1961. The nonmetallic construction materials, represented by cement, sand and gravel, and stone, comprised about 52 percent, 25 percent, and 22 percent, respectively, of the total value.

TABLE 1.—Mineral production in Puerto Rico [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement—thousand 376-pound barrels	5,931	$16,946	6,347	$20,018
Clays—thousand short tons	184	112	219	131
Lime—do	1	15	1	14
Sand and gravel—do	11,370	10,385	7,378	9,793
Stone—do	5,049	7,284	5,589	8,551
Total		[2] 34,742		38,507

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Revised figure.

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The economy of Puerto Rico rose to new heights in 1962 as evidenced by a 10 percent increase in net income to $1,650 million.[5] The construction industry was exceedingly active; total value of completed work reached a level of $305 million, $51 million more than the comparable figure for 1961. Construction of private housing and private commercial and industrial facilities were the most active sectors, accounting for 60 percent of all construction expenditures. Highways and public works were responsible for the remaining expenditures.

Value of imports into Puerto Rico totaled about $1.1 billion, a 10 percent gain compared with the value in 1961. Mineral fuel, metals, and other raw and processed mineral products comprised about 20 percent of the total value. The United States supplied about half of the imported mineral products. Crude and unfinished oil imports from Venezuela and the Netherlands Antilles increased 9 percent to an average of 95,650 barrels per day. The imported oil was processed by the two Puerto Rican oil refineries, which supplied feedstock to the petrochemical and other manufacturing industries, asphalt for paving, and fuel for various plants.

The U.S. Atomic Energy Commission (AEC), jointly with the Puerto Rico Water Resources Authority, continued construction of the $15 million nuclear powerplant near Rincón, Aguadilla District. Completion of the 16,000 kilowatt powerplant was scheduled for September 1963. Nuclear fuel for its superheater power unit was being received and installed.

Exploration for various minerals southeast of Lares continued for the fourth consecutive year by Bear Creek Mining Co. Newmont Exploration Co., Ltd., began an exploration project for copper in the La Muda area south of San Juan. Ponce Mining Co., subsidiary of American Metal Climax, Inc., completed a core drilling program on a large metallic mineral prospecting concession south of Utuado and reportedly located some 25 to 75 million tons of copper ore; American Metal proposed construction of a $28 million concentrator and smelter to exploit the deposits. Possible site for the concentrator was near the old Pellejas Sugar Mill in Adjuntas; probable location of the smelter was Ponce or Guánica, both south coast ports.

Aeromagnetic surveys conducted on prospecting concessions of A. D. Fraser in east-central Puerto Rico were geologically evaluated.

Plans were made for a cooperative Commonwealth-U.S. Government program to take aerial photographs of Puerto Rico and offshore islands. Two Federal agencies—Soil Conservation Service, Department of Agriculture, and Geological Survey, Department of the Interior—were to conduct and finance the project. The first major phase of the survey would cover municipalities in the eastern part of the Island, including San Juan, Caguas, Carolina, Gurabo, and Bayamón.

The Puerto Rico Economic Development Administration (PREDA) investigated clay deposits in the Cerro Candelero area in southeastern Puerto Rico. Results of the study were presented in a technical report, "Cerro Candelero, Yabucoa; an Economic Geology Study" by José F. Cadilla. The Federal Geological Survey, working under a cooperative agreement with PREDA, completed geologic mapping

[5] Report on Finances and Economy—1962 Fiscal Year, Department of the Treasury, Commonwealth of Puerto Rico, 26 pp.

of four quadrangles and began mapping three more. During 1962, geologic maps and reports on the Barranquitas,[6] Manatí,[7] and Bayamón[8] quadrangles were published.

The second phase of Project Mohole was started on the west coast of Puerto Rico. Drilling began on a 1,000-foot test well to core a serpentine outcrop located about 1.5 miles inland from Mayaguez. Results of the test were expected to furnish needed information about physical and chemical characteristics of serpentine, a dense rock which may lie just above the Mohorovicic discontinuity, which is the deep boundary between the earth's crust and mantle.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—The Puerto Rican cement industry retained its significant position in the overall mineral industry as value of cement shipments accounted for 52 percent of the total mineral production. Shipments of cement totaled 6.3 million barrels, a 7-percent increase over that of 1961. Stocks of cement at the two plants increased to 223,440 barrels at yearend. With the exception of gypsum, which was imported from the Dominican Republic, all raw materials used in Puerto Rican cement were from deposits near the plants.

Domestic demand for cement gained. As a result, Puerto Rican cement exports dropped 8 percent, to 1.4 million barrels; imported cement rose to 11 percent of total domestic shipments as compared with 7 percent in 1961.

TABLE 2.—Portland cement production and shipments

Year	Production (barrels)	Shipments		
		Barrels	Value	
			Total (thousands)	Average per barrel
1953–57 (average)	4,236,821	4,249,424	$12,560	$2.96
1958	5,861,862	4,747,976	15,175	3.20
1959	5,324,188	5,392,312	16,982	3.15
1960	5,415,086	5,441,497	14,546	2.67
1961	6,070,140	5,931,420	16,946	2.86
1962	6,364,736	6,346,662	20,018	3.15

New equipment installed at the Ponce plant of Ponce Cement Corp. included new coolers in two kilns, and dust controlling equipment consisting of an electric precipitator, gas analyzer, exhaust fan, and dust disposal.

Clays.—Production of clay for cement increased 23 percent over that of 1961. Clay used for making heavy clay products and other ceramics gained about 5 percent and was mined from the deposits near Carolina in the San Juan District. Statistics on the substantial

[6] Briggs, R. P., and P. A. Gelabert. Preliminary Report on the Geology of the Barranquitas Quadrangle, P.R. Geol. Survey Misc. Geol. Inv. Map I-336, 1962.
[7] Monroe, W. H. Geology of the Manatí Quadrangle, P.R. Geol. Survey Misc. Geol. Inv. Map I-334, 1962.
[8] Monroe, W. H., and M. H. Pease, Jr. Preliminary Geologic Map of the Bayamón Quadrangle, P.R. Geol. Survey Misc. Geol. Inv. Map I-347, 1962.

amount of clay material used as fill on various projects were not available and are not included in clay production data.

A plant to expand clay for use as lightweight aggregate was being built by Díaz Bros near San Juan, and completion was scheduled for late 1963. When operating, the efficiently designed plant would require a substantial amount of miscellaneous clay. Clay from the nearby pit was to be ground, sized, and stored in a covered shed. Clay would be reclaimed from the shed through a tunnel and conveyors would carry the material to the feed hoppers of the oil-burning rotary kiln. The clay would pass through the kiln, be expanded, go through a cooling kiln, and then to another conveyor that would carry it to sizing screens. At this point the bloated clay would be separated into three stockpiles—coarse, medium, and fine. The different sizes will be reclaimed, blended to meet different specifications, and placed in bins for loading into trucks.

Lime.—South Puerto Rico Sugar Corp. produced about 1,000 tons of lime for use in processing sugar. A small part of its lime production was sold to Caribe Nitrogen. Minor amounts were used for water purification and softening, and other industrial uses.

A new plant for production of hydrated lime was under construction by Florida Lime Corp. in Ponce.

Sand and Gravel.—Production of sand and gravel decreased 35 percent in quantity and 6 percent in total value. The sizable drop in tonnage resulted from a 4-million ton decrease in use of low-value fill sand on Government projects. The sand and gravel was produced from river valley deposits and beaches in all Senatorial Districts and transported exclusively by truck.

In September, dredging operations began on the San Juan harbor project. Over the next 2 years, about 12 million cubic yards of material would be removed to deepen the harbor so that it could accommodate the largest ships. The $8.5 million project was supervised by the U.S. Army Corps of Engineers.

Silica sand for cement, glassmaking, and other industrial uses was obtained from inland deposits west of San Juan.

Stone.—Total quantity of stone produced increased about 11 percent compared with that of 1961; value gained 17 percent.

Limestone was produced in all seven districts of the Island. Andesite, tuffaceous siltstone, and miscellaneous volcanic stone were produced in all districts except Arecibo. Granite was produced in Humacao District and Guayama District; basalt, in Mayagüez District. Stone output was 76 percent crushed limestone, 2 percent crushed granite, and 19 percent crushed miscellaneous stone. The remaining 3 percent consisted of rough dimension stone and crushed marble. The two cement plants reported the largest crushed stone output, totaling about 1.8 million tons.

MINERAL FUELS

The Cataño Plant of Caribbean Refining Co., San Juan District, and Commonwealth Oil Refining Co., Mayagüez district, refined record amounts of crude and unfinished oil imported from Venezuela. Products from these refineries were used in the growing chemical complex developing on the Island. The total number of chemical

TABLE 3.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,808	$2,728	1,746	$2,711
Paving	1,549	1,529	1,614	1,600
Fill	501	220	513	325
Other	98	104	102	108
Total	3,956	4,581	3,975	4,744
Gravel:				
Building	1,299	2,348	1,195	2,213
Paving	1,217	2,014	989	1,852
Fill	210	129	305	197
Other			167	155
Total	2,726	4,491	2,656	4,417
Total sand and gravel	6,682	9,072	6,631	9,161
Government-and-contractor operations:				
Sand:				
Building	8	13	5	7
Paving	96	116	182	178
Fill	4,506	1,050	434	322
Total	4,610	1,179	621	507
Gravel:				
Building	5	19	6	8
Paving	65	99	20	34
Fill	8	16	100	83
Total	78	134	126	125
Total sand and gravel	4,688	1,313	747	632
Grand total	11,370	10,385	7,378	9,793

plants in Puerto Rico reached 90 in 1962, and chemical exports to the United States from Puerto Rico climbed to $35.2 million.

Reichhold Chemical del Caribe, a United States-Puerto Rico owned company, began operating its new plant to produce polyvinyl latex, acrylic latex, alkyl resins, and polyester resins. The plant at Río Piedras was valued at about $500,000. Output of the chemical plant was utilized in making paint, paper, leather, textiles, plastic boats, rubber, metal adhesives, and aviation supplies.

TABLE 4.—Stone sold or used by producers

Year	Dimension limestone		Crushed limestone [1]		Miscellaneous stone [2]		Total	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1953–57 (average)	91,261	$186	1,639,158	$2,256	20,434	$31	1,750,853	$2,473
1958	148,146	281	1,777,656	2,352	60,000	135	1,985,802	2,768
1959	10,322	23	1,980,840	2,693	72,000	162	2,063,162	2,878
1960	36,941	87	3,474,462	5,938	708,080	1,636	4,219,483	7,661
1961	[3] 77,133	213	3,718,011	4,546	1,253,524	2,525	5,048,668	7,284
1962	60,787	130	4,269,840	5,829	1,258,080	2,592	5,588,707	8,551

[1] Includes limestone for cement and lime.
[2] Includes granite, andesite, tuffaceous siltstone, and crushed marble.
[3] Includes dimension marble.

TABLE 5.—Value of mineral production in Puerto Rico, by districts

Senatorial district	1961	1962	Mineral products produced in order of value
Aguadilla	$1,339,610	$1,322,185	Stone, sand and gravel.
Arecibo	1,055,729	1,211,715	Do.
Guayama	1,496,490	1,525,780	Sand and gravel, stone.
Humacao	729,684	731,798	Stone, sand and gravel.
Mayagüez	2,750,401	2,194,189	Sand and gravel, stone, lime.
Ponce	[1] 12,177,603	12,472,442	Cement, sand and gravel, stone, clays.
San Juan	[1] 15,192,709	19,049,201	Do.
Total	[1] 34,742,226	38,507,310	

[1] Revised figure.

METALS

Siderurgica Industrial, Inc., the only steel mill in Puerto Rico, produced reinforcing bars from domestic and imported iron and steel scrap and planned to install a 20-ton electric furnace to expand its facilities to a capacity of 65,000 tons per year. The completion of the additional facilities was scheduled for early 1964.

PANAMA CANAL ZONE [9]

Mineral production in the Panama Canal Zone gained in overall quantity and value. An increased unit price for sand produced by Panama Sand Co., Inc., offset a drop in quantity. Basalt and miscellaneous stone production increased 27 percent in quantity and total value was 33 percent higher than in 1961.

VIRGIN ISLANDS [10]

Production of basalt in the Virgin Islands increased about 5 percent in quantity and 9 percent in value compared with that of 1961. Principal uses of the stone were for concrete aggregate, roadstone, and riprap.

TABLE 6.—Mineral production in the Panama Canal Zone and Virgin Islands [1]

Mineral	1961		1962	
	Short tons	Value	Short tons	Value
Canal Zone:				
Sand and gravel	75,204	$73,274	70,268	$76,914
Stone [2]	162,704	270,880	207,373	359,173
Total		344,154		436,087
Virgin Islands: Stone (basalt)	20,302	75,399	21,273	82,348

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Includes basalt.

[9] Prepared by Harry F. Robertson.
[10] Prepared by Harry F. Robertson.

TABLE 7.—Sand and gravel sold or used by producers in the Panama Canal Zone

Year	Short tons	Value
1953-57 (average)	32,384	$38,280
1958	41,006	34,616
1959	14,392	20,500
1960	65,000	68,149
1961	75,204	73,274
1962	70,268	76,914

TABLE 8.—Crushed basalt and miscellaneous stone sold or used by producers in the Panama Canal Zone

Year	Short tons	Value
1953-57 (average)	153,099	$208,970
1958	140,464	236,848
1959	223,348	270,085
1960	203,355	305,914
1961 [1]	162,704	270,780
1962	207,373	359,173

[1] Revised figures.

The domestic water supply on St. Thomas Island improved. After correcting various mechanical difficulties, the new $2.5 million sea water conversion and electric turbogenerating plant at Krum Bay, St. Thomas Island, produced 315,000 gallons of pure water per day.

The Virgin Islands Planning Board contracted for a survey which would produce topographical maps of the Virgin Islands.

Work began on a $265,000 contract for the U.S. Army Corps of Engineers to deepen Christiansted Harbor, St. Croix. The contract, awarded to Nat Harrison Associates, Inc. Miami, Fla., provided for the removal of large ballast stones and one or more sunken vessels in addition to widening and deepening the harbor channel. The harbor, when completed in early 1963, would be 16 feet deep.

Harvey Aluminum, Inc. completed core drilling in connection with the building of its new $25 million Virgin Island aluminum processing operation in October. In early 1963, a channel was to be dredged to transport heavy equipment from the coast to the plant site. The plant will produce alumina for shipment to the company plant in Oregon. Production of 100,000 tons per year was planned.

TABLE 9.—Crushed basalt sold or used by producers in the Virgin Islands

Year	Short tons	Value
1953-57 (average)	[1] 7,739	$26,174
1958	25,296	80,586
1959	14,429	50,616
1960	14,895	51,287
1961	20,302	75,399
1962	21,273	82,348

[1] Includes miscellaneous stone.

PACIFIC ISLAND POSSESSIONS [11]

REVIEW BY ISLANDS

American Samoa.—"Operation Samoa," a crash program to complete more than $7-million worth of new construction, required the production of over 1 million tons of basalt rock, coral limestone, volcanic cinder, and beach sand. These materials were produced by Samoan public works crews, assisted by technicians from the District Public Works Office of the 14th Naval District. Substantial quantities of concrete aggregate were crushed and screened for use in building a jet airfield, roads, schools, a multipurpose civic auditorium, residences, and other facilities. The new 9,000-foot jet runway at Tafuna Airport was dedicated by Secretary of the Interior, Stewart L. Udall, when he arrived to open the six-nation South Pacific Conference held at American Samoa in July.

Canton.—Maintenance crews of the Federal Aviation Agency quarried coral limestone for use in repairing the island's macadamized roads.

TABLE 10.—Mineral production in the Pacific Island Possessions

Area and mineral	1961		1962	
	Short tons	Value	Short tons	Value
American Samoa:				
Pumice (volcanic cinder)			50,490	$108,192
Sand			2,717	3,705
Stone (crushed)	361,514	$286,151	1,103,113	1,787,830
Total		286,151		1,899,727
Canton: Stone (crushed)			130	500
Guam:				
Sand	38,756	49,369		
Stone (crushed)	292,231	591,303	81,745	122,938
Total		640,672		122,938
Johnston:				
Sand	540	1,200		
Stone (crushed)	675	1,500		
Total		2,700		
Midway: Stone (crushed)	10,902	33,544		
Wake: Stone (crushed)	23,830	62,338	4,880	40,750

Guam.—Public works crews and commercial producers, including Hawaiian Rock Products, Inc., at Barrigada, quarried and processed coral limestone and coral stone sand for base course and for portland cement and bituminous concrete aggregate.

In November, Guam was battered by Typhoon Karen, an unprecedented tropical storm which virtually leveled the private and public facilities on the island. It was reported that a considerable volume of locally produced and imported mineral material would be required in 1963 for the urgent restoration program.

Wake.—Wake Island maintenance crews and contractors from Guam and the U.S. mainland, quarried coral limestone for railroad ballast and for construction of roads and concrete structures.

Other Pacific Island Possessions.—No mineral production was reported during 1962 on the Islands of Enderbury, Jarvis, Johnston, Midway, and Palmyra.

[11] Prepared by Roy Y. Ashizawa.

The Mineral Industry of Rhode Island

By Joseph Krickich [1]

VALUE of mineral production in Rhode Island in 1962 decreased slightly but was the third highest on record. The year was marked by continued acceleration in highway construction, which resulted in higher production of sand and gravel. Output of granite riprap dropped sharply, compared with the previous year. Providence and Kent Counties continued to be the leading mineral producing areas.

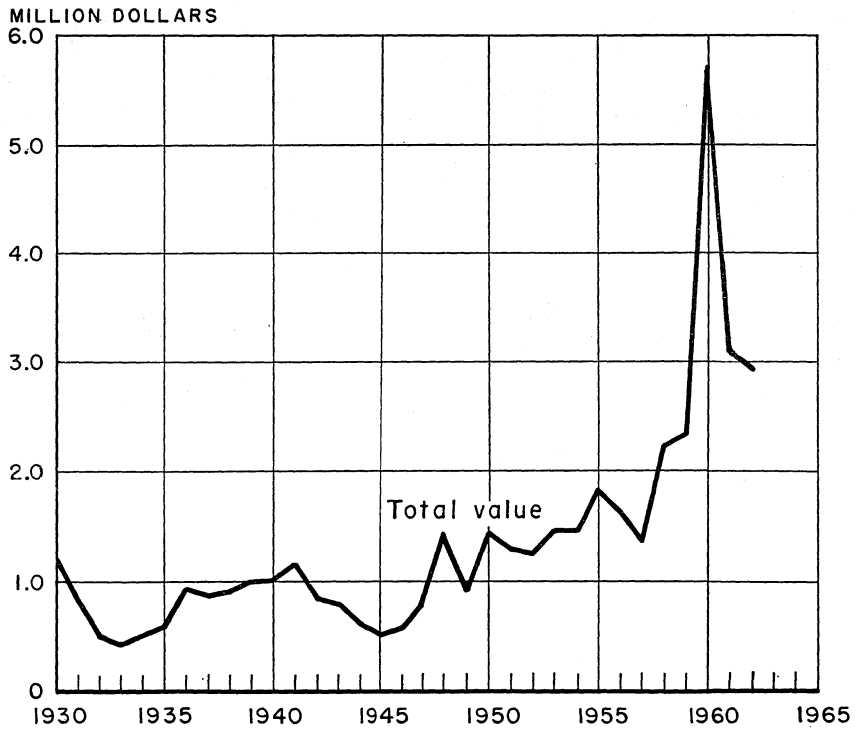

FIGURE 1.—Total value of mineral production in Rhode Island, 1930–62.

[1] Mineral specialist, Bureau of Mines, Pittsburgh, Pa.

TABLE 1.—Value of mineral production in Rhode Island, by counties

(Thousands)

County	1961	1962	Minerals produced in 1962, in order of value
Bristol	(1)		
Kent	(1)	(1)	Sand and gravel.
Newport	$556	$254	Stone, sand and gravel.
Providence	1,226	1,381	Do.
Washington	361	330	Sand and gravel, stone.
Undistributed[2]	936	1,029	
Total	3,079	2,994	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes value of gem stones and sand and gravel (1962) not specified by counties.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Two recently constructed bulk cement distribution terminals in Providence County were active. Cement produced in New York was transported in specially designed ships to Providence for storage and redistribution.

Gem Stones.—Various mineral specimens were recovered from quarries and old mine dumps throughout the State. Types of minerals recovered by collectors included agate, actinolite, fluorescent calcite, and pegmatite minerals. Most of these minerals were collected from localities in the northern part of the State, mainly near North Smithfield.

Sand and Gravel.—Output of sand and gravel totaled 2.3 million tons, a 36 percent increase over 1961. Both commercial and Government-and-contractor production increased. The increase was attributed mainly to greater demand for fill material. Most of the commercial production was used for building and paving (54 percent) and fill material (36 percent). The remainder was used for molding sand and other uses. Sixty-two percent of the State's total output was processed material, compared with 74 percent in 1961, reflecting increased use of fill material. The average value per ton of commercial sand and gravel dropped from $0.97 in 1961 to $0.82. There were 25 commercial producers, 3 of which had portable operations. Most of the sand and gravel was transported by truck; less than 1 percent was shipped by rail.

Stone.—Production of stone decreased nearly one-third compared with 1961. Decreased demand for granite riprap and crushed miscellaneous stone for concrete aggregate accounted for the decline. Output of limestone, produced in Providence County, increased slightly. The limestone was used mainly as agstone (agricultural stone) and roofing gravel. Miscellaneous stone was quarried in Providence and Newport Counties and was used chiefly as concrete aggregate and roadstone. Some was used for riprap and railroad ballast. Crushed and broken granite was produced in Newport, Providence, and Washington Counties. Most of the material was used as riprap. A limited quantity of granite was produced in Providence County by Government-and-contractor operations. Dimension granite produc-

tion in Washington County for construction and monumental purposes was greater than in 1961. Granite quarried in Massachusetts and other States was processed into finished dimension stone at a fabricating yard in Providence County.

METALS

Washburn Wire Co. produced basic steel at four open-hearth furnaces at Philipsdale. Annual capacity at the plant was 93,000 tons of steel ingots. Pig iron, iron and steel scrap, ferroalloys, and other raw materials were obtained mainly from other States for consumption at the plant. Cold-rolled strip steel was produced at two plants at Pawtucket. Combined capacity of these plants was 32,000 tons. Ferrous scrap consumed by the iron and steel industry was principally No. 2 heavy melting, cast iron, and low-phosphorous grades. Nonferrous scrap was melted and refined at a plant near Providence for the production of pig lead, solder, babbits, and caulking leads. Aluminum, brass, bronze, gray iron, malleable iron, and other castings were produced in numerous foundries throughout the State.

REVIEW BY COUNTIES

Sand and gravel was produced under contract for the State of Rhode Island, Division of Roads and Bridges, Department of Public Works, at many locations in the State. Total output increased and consisted entirely of processed paving sand and gravel.

Bristol.—L. Romano Construction Co. discontinued sand and gravel production at its pit near Barrington.

Kent.—Kent County continued as the leading sand-and-gravel-producing area. Output increased 63 percent and was used chiefly for building and paving and as fill material. Sand also was produced for ice control on roads and for foundry molds. Over one-half of the State's sand and gravel was produced in this county. Principal producers were Rhode Island Sand and Gravel Co. and Luigi Vallone, Inc., both near Warwick; Barber Sand and Gravel, Coventry; and Whitehead Brothers Co., Washington.

Newport.—M. A. Gammino Construction Co. quarried granite at Tiverton. Output consisted of random and selected riprap used for construction of breakwater facilities for the U.S. Naval Base at Newport. Production declined as the project neared completion. Riprap stone from a quarry in Washington County also was used in the project. The riprap was transported on a skow to the construction site. Peckham Bros. Co., Inc., produced conglomerate and paving sand and gravel at Middletown. The stone was crushed for concrete aggregate and roadstone.

Providence.—Miscellaneous stone was quarried by M. A. Gammino Construction Co. at Cranston. Most of the stone was crushed and washed for use as concrete aggregate and roadstone. Some was sold as railroad ballast and as riprap for constructing the Fox Point Hurricane Barrier across the Providence River at Providence. The $17 million project was a combination dam and seawall designed to prevent flooding during severe storms. Limestone was quarried at

Lincoln by the Conklin Limestone Co., Inc. Most of it was crushed for use as agstone, roofing gravel, blast-furnace flux, fertilizer filler, and cast-stone aggregate. Some dimension stone was used as rubble. The Berkeley granite quarry of Fanning and Doorley Construction Co., Inc., was not operated in 1962. The company planned to sell the property. Dimension granite was processed and fabricated at the Providence yard of Providence Granite Co. Granite used in architectural applications and for curbing was processed from stone quarried in Massachusetts by a subsidiary company and from other States and foreign countries.

Production of commercial sand and gravel increased 54 percent. Seventy-five percent of the commercial output was washed, screened, or otherwise prepared, compared with 78 percent in 1961. Most of the output was used for highway construction and maintenance and other construction. Some sand for ice control, foundry use, and for manufacturing masonry blocks also was produced. All of the county production was transported to markets by trucks. Principal producers were A. Cardi Construction Co., Inc., Del Bonis Sand and Gravel Co., and Andrews Sand and Gravel Co., all near Cranston; L. Romano Construction Co., East Providence; Silvestri Bros., Inc. and Joseph Santoro, Inc., both near Johnston; Tasca Sand & Gravel Co., Smithfield; Cormier Sand & Gravel, Inc., Lincoln; Town Line Sand & Gravel, Slatersville; Foster Sand & Gravel Co., Inc., Foster; Mack Construction Co., Berkeley; and Forte Bros., Inc., Cumberland.

Lehigh Portland Cement Co. and Marquette Cement Mfg. Co. distributed bulk cement at recently constructed terminals at Providence. Both companies produced cement in New York and transported it in specially designed, self-unloading ships.

The petroleum refineries of Mobil Oil Co. at East Providence and Texaco, Inc., at Providence, were shut down during 1962. Both were skimming and asphalt plants and had a combined capacity of 14,700 barrels per day.

Washington.—Output of sand and gravel decreased 34 perccent compared with 1961. Most of the output was used as building and paving material and consisted chiefly of processed material. Principal producers were South County Sand & Gravel Co. and Louis B. Schaeffer, both near Peace Dale, and James Romanella & Sons, Inc., Westerly. Gencarelli, Inc., Westerly, quarried granite for riprap for seawall construction at Point Judith for the U.S. Army Corps of Engineers. Westerly Granite Corp., Bradford, produced granite for rough construction work and monumental stone. The company also supplied riprap to M. A. Gammino Construction Co. for constructing breakwater facilities at Newport, Rhode Island.

The Mineral Industry of South Carolina

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the South Carolina Geological Survey, for collecting information on all minerals except fuels.

By Lawrence E. Shirley[1] and Henry S. Johnson, Jr.[2]

SOUTH CAROLINA established a new high in the production of mineral commodities in 1962, with a total value of $34 million. During the past decade mineral production value, as reported to the Bureau of Mines, has almost doubled. Total mineral production value increased over $2.5 million, or 8 percent over that of 1961. Leading commodities in order of total value were cement (masonry and portland); stone (crushed and dimension granite, crushed limestone, and crushed sandstone), clays (kaolin and miscellaneous), sand and gravel, and vermiculite. These five commodities accounted for 96 percent of the total value of the mineral production.

TABLE 1.—Mineral production in South Carolina[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clay—thousand short tons	1,346	$6,169	1,518	$7,165
Mica (sheet)—pounds	12	(2)		
Sand and gravel—thousand short tons	2,904	3,067	3,318	3,670
Stone—do	6,752	9,827	6,382	10,066
Value of items that cannot be disclosed: Barite, cement, feldspar, gem stones (1962), kyanite, scrap mica, peat, pyrites, and vermiculite		12,311		13,000
Total		[3] 31,374		33,901

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value less than $500.
[3] Revised figure.

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[2] State geologist, South Carolina Geological Survey, Columbia, S.C.

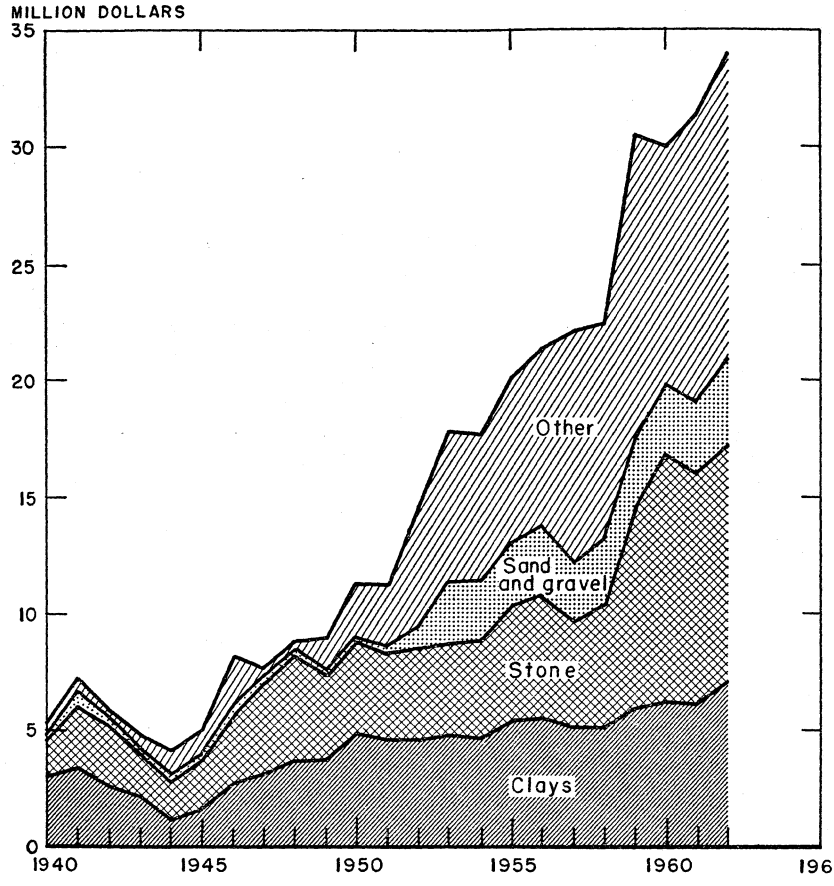

FIGURE 1.—Value of clays, stone, sand and gravel, and total value of minerals produced in South Carolina, 1941–62.

Commodities establishing all time high records were sand and gravel, which had its best year since 1956, kaolin, miscellaneous clay, masonry and portland cements, kyanite, and crushed sandstone. South Carolina, as in 1961, ranked second in the Nation in the output of kaolin, kyanite, and vermiculite, and fourth in crushed granite. Leading companies mining and processing minerals were Carolina Giant Division of Giant Portland Cement Co. (portland and masonry cement, miscellaneous clay, and limestone), Campbell Limestone Co. (crushed granite and limestone), J. M. Huber Corp. (kaolin), Becker County Sand & Gravel Co. (sand and gravel), Zonolite Co. (vermiculite), and Palmetto Quarries Co. (crushed granite). Commodities showing decreases were barite, sheet mica, crushed and dimension granite, crushed limestone, pyrite, and vermiculite.

Employment and Injuries.—Reports submitted by producers in the mineral industries indicated that 5 percent more mines, quarries,

and mills were active in 1962 than in 1961, and that employment (including officeworkers), increased 3 percent. Employment increased 15 percent in nonmetal mines, decreased 16 percent in quarries and mills, and increased 18 percent in sand and gravel mines. Average active days worked decreased 4 percent in all categories; decreased 17 percent in nonmetal mines, increased 11 percent in quarries and mills and increased 16 percent in sand and gravel mines. Total man-hours worked increased by 409,000, or 9 percent.

TABLE 2.—Employment and injuries in the mineral industries

Year and industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:							
Nonmetal mines	40	1,138	251	2,379,243	1	43	18
Quarries and mills	21	944	232	1,844,882		35	19
Sand and gravel mines	23	242	242	474,433	1	10	23
Total	84	2,324	242	4,698,558	2	88	19
1962: [1]							
Nonmetal mines	39	1,309	208	2,817,944		37	13
Quarries and mills	18	797	258	1,646,067		41	25
Sand and gravel mines	31	286	281	643,791		11	17
Total	88	2,392	233	5,107,822		89	17

[1] Preliminary figures.

The overall frequency rate for injuries per million man-hours for all operations decreased 11 percent below the frequency rate for 1961. Nonmetal mines and sand and gravel mines showed decreases, but quarries and mills increased 32 percent over that of 1961, when a large decrease was experienced. Nonfatal injuries increased slightly above the 1961 figure; there was a 14 percent decrease in nonmetal mine injuries, and slight to moderate increases in sand and gravel mines, and in quarries and mills. Revised figures for fatal injuries in all categories indicated two fatal injuries for 1961, and no fatal injuries were reported in 1962.

Trends and Developments.—The Division of Geology, State Development Board continued its basic program of mineral resources investigations [3] throughout the State. At yearend, studies were in progress on the geology and mineral resources of Edgefield, Horry, Newberry, Oconee, Pickens, Orangeburg, and York Counties; field and laboratory work was in progress or essentially completed, and some reports on the county studies were under preparation for a bulletin series. In addition, work on the geology of seven 7½-minute and two 15-minute quadrangles was in progress. Reports were published on barite and limestone resources in the State, and a report was in preparation on montmorillonite or fuller's earth clays. This work and its continuation in the future is very important to the present and future development of the mineral industry in the State. Increased consumption of mineral products necessary for industrial growth is

[3] Johnson, H. S., Jr. Geologic Activities in South Carolina. Geologic Notes. Div. of Geol., State Development Bd., v. 7, Nos. 1, 2, January–April 1963, 5 pp.

indicated by continued increases in output of sand and gravel, cement, and other construction products, such as miscellaneous clay for heavy clay products and stone.

South Carolina, under the Interstate Highway System, opened 285.7 miles of its interstate and defense system highways by yearend. Another 126.9 miles of roadway was in progress with interstate funds; 60 miles were under construction while engineering or right-of-way steps were being taken on another 66.6 miles. When completed the interstate-defense highway system would total 678.8 miles. A total of 266.1 miles remained to be completed. By the end of 1962 over $100 million had been spent for interstate work, $96 million of it in Federal funds. Another $51.6 million was earmarked for work underway, of which $46 million was to come from the Government. Under the primary, secondary, and urban system, South Carolina had completed 3,813 miles of roadway at a cost of $138.6 million and the State had 985 miles of this system in programs.

Significant electric power programs were completed. South Carolina Electric & Gas Co., about midyear, dedicated its Canadys Station plant near Walterboro, Colleton County, which was designed to have an eventual generating capacity of 550,000 kilowatts. Present capability was 137,500 kilowatts and a second unit under construction was to be completed in 1964. The station was built to supplement the central and southern parts of the 23 counties served by the utility. The station was designed to use either pulverized coal or natural gas for firing the boilers; operating at full capacity, each unit would require approximately 25 carloads or 2,500 tons of coal per day. For operation on natural gas, a 14-inch main would transmit fuel from the delivery point of the company's supplier near Aiken. A new gas turbine and generating unit was installed near Myrtle Beach by Santee-Cooper during the third quarter; the new plant of 15,000 horsepower had a generating capacity of 13,000 kilovolt-amperes per unit and was designed to burn fuel oil.

Progress was made in port developments in an effort to meet demands for increased trade through South Carolina ports. Construction began on a molten sulfur facility at the North Charleston terminals of the State Port Authority; a contract was signed with Freeport Sulfur Co., New York, for construction of the facility.

A comprehensive study of the transportation complex in South Carolina was published.[4] With the rapid industrial expansion of the Southern States, the South Carolina General Assembly established the State Organization for Associated Research (SOAR) to sponsor scientific studies to provide information for existing industries, and as an aid in pointing out the State's advantages to industries contemplating relocation or branch plants for existing facilities. This was the first of the studies completed. In progress was an industrial markets survey study concerning estimated annual materials consumption of South Carolina manufacturing establishments which was to be published in 1963.

Legislation and Government Programs.—The State Development Board was designated by the Governor as the coordinating agency for Area

[4] Bennett, James W., Jr. and Others. An analysis of the Transportation Complex of the State of South Carolina, Univ. South Carolina, Bur. of Business and Econ. Res. SOAR Report 1A–1B, 1961, 314 pp.

Redevelopment Administration (ARA) matters in South Carolina. At yearend, several ARA projects were in progress making possible the expansion of present industrial plants and increasing employment. The ARA Act made it possible for designated counties to receive assistance in improving their economic status through the expansion of existing industry and location of new facilities.

The South Carolina Water Pollution Control Authority, acting in the capacity of a Water Policy Commission, and with the cooperation of a legislative committee, took steps for the establishment of a water policy for the State. The committee, recognizing the need for a sound, progressive and proper water policy and program, recommended an appropriation of $25,000 for the Authority to make studies leading to the development of a recommended water policy for consideration of the State legislature.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Industrial Minerals, Inc., Cherokee County, the only barite producer in the State, decreased production by 14 percent, but value increased slightly. The crude barite was ground for use as a rubber filler and shipped out of State. This was the first year since 1958 that barite output showed a decrease. In September the Division of Geology, State Development Board, Columbia, released Bulletin 27, Barium Resources of South Carolina; the 22-page report gives information on the barite deposits in the State and provides general background data on occurrences, uses, specifications, and prices of barium ores.

Cement.—By value, cement was the leading commodity in the State. Masonry cement continues to establish record output, with increases each year since 1957. The 1962 record was 30 percent in quantity, and 31 percent greater in value than the 1961 sales. Portland cement established a new record and increased 9 percent in quantity and 7 percent in value; the previous record year was 1959. Both types of cement were manufactured by Carolina Giant Division of Giant Portland Cement Co., near Harleyville, Dorchester County. Carolina Giant installed a new mill designed to finish grind an additional 6,000 barrels of cement per day. This mill and its auxiliary equipment, including a cement cooler, was controlled from a new central control room. In 1962 the company expended approximately $1.6 million for plant improvements and modernization. New cement manufacturing facilities were completed, or under construction in Georgia and North Carolina in the marketing area of the company.

Clays.—By value, clay was the third leading commodity in the State, as in 1961, and accounted for 21 percent of the total mineral production value. Total clay output set a new record and increased 13 percent in tonnage and 16 percent in value. South Carolina continued to rank second in the Nation in production of kaolin, exceeded only by neighboring Georgia. Kaolin production also established a new high and increased 22 percent in tonnage and 18 percent in value; total output was 528,000 tons valued at $6.3 million. Twenty-three

TABLE 3.—Kaolin sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Rubber	221,310	$2,828,671	$12.78	266,678	$3,590.158	$13.46
Firebrick and block	12,362	71,826	5.81	48,400	290.084	5.99
Insecticides and fungicides	21,875	276,359	12.63	24,041	297.289	12.37
Other refractories	36,452	218,289	5.99	20.000	96.800	4.84
Heavy clay products				10.000	48.400	4.84
Saggers, pins, stilts, and wads	(1)	(1)	(1)	7.000	59.665	8.52
Architectural terracotta				2,840	13,973	4.92
Paint	3,898	54,960	14.10	(1)	(1)	(1)
Other uses	[2] 137,851	[2] 1,850,404	[2] 13.42	[2] 149,034	[2] 1,882,762	[2] 12.63
Total	433,748	5,300,509	12.22	527,993	6,279,131	11.89

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[2] Included whiteware, art pottery, fire-clay mortar, paper filling, paper coating (1961), linoleum and oilcloth, fertilizers, plaster and plaster products, other fillers, chemicals, exports, other uses, and uses indicated by footnote 1.

thousand tons of kaolin was exported. Kaolin was produced at 17 mines by 11 companies in Aiken and Richland Counties, 1 mine more than in 1961. Principal uses of kaolin were in refractories, consisting of firebrick and block, fire clay mortar, saggers, pins, stilts and wads, and other uses; as filler material in rubber, insecticides and fungicides, paint, fertilizer, plaster and plaster products, linoleum and oilcloth, cement, roofing, adhesives, and for miscellaneous uses; as pottery and stoneware in pottery, flowerpots, and glaze slip. J. M. Huber Corp., the largest producer of kaolin in the State, operated four mines during 1962; the Clay Division of Huber had its headquarters at Langley, and plants at Langley and Graniteville, S.C., and Huber, Ga. Other leading producers listed in descending order of rank were Dixie Clay Products and National Kaolin Products Co., both of Aiken County. Southeastern Clay Co. also operated four mines in Aiken County. D. T. Duncan, a new producer in Richland County, produced kaolin for heavy clay products.

Miscellaneous clay production increased 8 percent in tonnage and 2 percent in value over the previous record year 1961; total output was 990,000 tons valued at $886,000. Miscellaneous clay was used for heavy clay products such as building brick, paving brick, draintile, sewer pipe and kindred products, and in the manufacture of cement. Eleven companies in 11 counties produced miscellaneous clay from 19 mines. Leading counties, in order of output, were Dorchester, Richland, Marlboro, and Greenwood, all producing in excess of 100,000 tons of clay. The leading producers of miscellaneous clay were Carolina Giant Division of Giant Portland Cement Co. (Dorchester County), Columbia Brick & Tile Co. and Carolina Ceramics, Inc. (Richland County), Southern Brick Co. (Greenwood County), and Ashe Brick Co. (Lancaster County).

Eastern Brick & Tile Co., Sumter County plant was described.[5] The mining, processing from raw material to finished brick, equip-

[5] Brick and Clay Record. New South Carolina Plant to Help Fill State Demands. V. 141, No. 6, December 1962, pp. 42–44.

ment used and transportation of the product was given. Shipments of brick were made by the company as far north as New York City and as far south as Florida.

Feldspar.—Spartan Minerals Co., formerly Paco Products, Inc., Pacolet, produced feldspar from granite screenings obtained from the Campbell Limestone Co. Pacolet quarry; quantity and value decreased considerably below that of 1961. The material was ground and principally shipped out of State for use by the glass industry. Spartan Minerals Co., reported to be a subsidiary of Spartan Mills (Spartanburg), acquired Paco Products about midyear for the purpose of supplying raw materials for the glass, ceramic, paint, and rubber industries. The plant had operated for 4 years.

Gem Stones.—Frank L. Sims, West Columbia, collected a small amount of quartz classified as mineral specimens from an unknown source in Lexington County.

Kyanite.—Kyanite output was at an alltime high, but continued to rank below Virginia, the only other kyanite-producing State; the previous record year was 1957. Tonnage increased 10 percent and value, 11 percent. Commercialores, Inc., Henry Knob mine, York County, the only producer, mined, processed, and shipped the material to refractories manufacturers.

Mica.—No sheet mica production was reported for the first time in many years. A downward trend had been evident in production since incentives formerly provided by the Government purchasing program were discontinued. Scrap mica production increased slightly in quantity and value; Mineral Mining Corp., Kershaw, the only scrap producer in the State, continued recovery of scrap mica from an open-cut mica schist deposit in Lancaster County. The material was dry ground and used in the manufacture of pipeline enamel, paint, plastics, welding rods, electric products, and other uses.

TABLE 4.—Sand and gravel sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Anderson	3,000	$990	6,695	$2,276
Chester	1,479	591	616	246
Chesterfield	(1)	(1)	253,596	253,261
Dorchester	20,354	15,077	(1)	(1)
Greenville	64,976	32,011	70,728	35,015
Lancaster	2,270	567	2,005	501
Lexington	582,887	266,819	693,267	573,440
Marion			4,200	4,200
Oconee	6,976	2,302	6,426	2,180
Richland	(1)	(1)	221,144	93,079
Spartanburg	1,017	508	1,689	844
Union			150	112
York	900	297	1,667	567
Undistributed [1]	2,220,057	2,747,824	2,055,973	2,704,303
Total	2,903,916	3,066,986	3,318,156	3,670,024

[1] Includes the following counties for which figures are withheld to avoid disclosing individual company confidential data: Aiken, Charleston, Cherokee, Florence, Horry, Jasper, Kershaw, Marlboro, Orangeburg (1961), and Sumter.

TABLE 5.—Sand and gravel sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	968,385	$469,377	$0.48	1,336,423	$724,732	$0.54
Paving	479,588	168,269	.35	325,583	130 129	.40
Fill	(1)	(1)	(1)	104,610	42,541	.41
Engine	22,752	56,703	2.49	24,366	73,646	3.02
Filtration	9,130	24,530	2.69	(2)	(2)	(2)
Other [3]	(1)	(1)	(1)	296,071	740,380	2.50
Total	(1)	(1)	(1)	2,087,053	1,711,428	.82
Gravel:						
Total	(1)	(1)	(1)	1,231,103	1,958,596	1.59
Total sand and gravel	2,903,916	3,066,986	1.06	3,318,156	3,670,024	1.11

[1] Figure withheld to avoid disclosure of individual company confidential data, included with "Total sand and gravel."
[2] Figure withheld to avoid disclosure of individual company confidential data; included with "Other sand."
[3] Includes glass, molding, blast, fire, filler, railroad ballast, and other gravel.
[4] Includes structural, paving, railroad ballast, and other gravel.

Pyrites.—Produced as a byproduct of milling kyanite, pyrite decreased considerably below 1961. Output was reported for the third year by Commercialores, Inc., York County. The material was shipped for out-of-State consumption. Commercialores was the only kyanite and pyrite producer in the State.

Sand and Gravel.—An alltime high record was established by sand and gravel production in South Carolina, exceeding the previous 1956 record year by 3 percent in tonnage and 25 percent in value. By value, sand and gravel was the fourth leading commodity in the State for the third consecutive year. Total production was 3.3 million tons valued at $3.7 million, an increase of 14 percent in quantity and 20 percent in value over that of 1961; sand and gravel accounted for 11 percent of the State's total mineral production value. Sixty-three percent of the material was sand and the remaining 37 percent was gravel. Commercial sand and gravel output was 99 percent of the total quantity and the remainder was Government-and-contractor. Commercial sand and gravel was produced by 26 companies at 29 mines in 15 counties; Government-and-contractor sand was produced in 12 counties by the State highway department for paving and general road maintenance purposes. Sixty-three percent of the sand and gravel was transported by truck and 37 percent by railroad; 74 percent of the total tonnage was processed and the remaining 26 percent unprocessed. None of the Government-and-contractor sand was processed. Leading counties, in order of tonnage produced and all in excess of 200,000 tons, were Marlboro, Lexington, Sumter, Chesterfield, Aiken, and Richland Counties; these six counties accounted for 85 percent of the total tonnage and 82 percent of total value for 1962. The three leading producers, listed in order of tonnage produced were Becker County Sand & Gravel Co., with operations in Marlboro, Sumter, and Chesterfield Counties; Capital Sand Co., and

Columbia Silica Sand Co., both of Lexington County. Information concerning products sold or used was collected on the broad classifications of construction, industrial, and ground sand, and construction gravel. Construction sand used consisted of building, paving, railroad ballast, fill sand, and other uses; industrial sand was used for glass (for melting only), molding, blast, fire or furnace, engine, filtration, and other uses; ground sand was used for glass, filler, pottery, and other purposes. Construction gravel was used for building, paving, railroad ballast, and other uses.

New sand and gravel mines placed in operation and new developments during 1962 were as follows: Pennsylvania Glass Sand Co., Columbia mine and plant, Lexington County, began producing industrial silica sand and ground silica in March. Increasing demand for ground silica from the new plant required the subsequent installation of additional milling capacity. Augusta Sand Co. (Clearwater mine), Aiken County, began producing construction sand and gravel. The new Ware Shoals mine and plant, Greenwood County, of the Perry Minerals Co., was completed and placed in operation. Two new construction sand mines began producing in Chesterfield County, Charlotte Sand Co. and Honeycut Bros. Sand & Gravel Co. both of Charlotte, N.C. Owens-Corning Fiberglas Corp. announced a $2.5 million expansion and improvement of its Anderson plant late in the year. The project would include changes for new processes, addition of a chemical manufacturing facility, and plant improvements.

Stone.—Although stone production lead all commodities in 1961, it dropped in value to the second ranking commodity in 1962, yielding first place to cement. Crushed sandstone established a new record increasing production considerably over that of 1961. Total stone production, including crushed granite, dimension granite, crushed limestone, and crushed sandstone, was 6.4 million tons valued at $10 million, a decrease of 4 percent in tonnage, but an increase of 2 percent in value, compared with 1961. Crushed granite output decreased 6 percent, but value increased 5 percent; dimension granite decreased 29 and 13 percent; crushed limestone showed decreases of 2 and 12 percent; and crushed sandstone increased 56 and 78 percent.

TABLE 6.—Crushed granite sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roadstone	4,767,788	$6,895,621	$1.45	4,274,360	$6,432,015	$1.50
Railroad ballast	211,433	258,990	1.22	329,702	411,500	1.25
Other uses [1]	531,838	306,336	.58	556,971	982,304	1.76
Total	5,511,059	7,460,947	1.35	5,161,033	7,825,819	1.52

[1] Includes stone sand, poultry grit, riprap, and other uses.

Crushed granite was produced from 10 quarries by 5 companies in 8 counties, compared with production from 13 quarries operated by 7 companies in 9 counties in 1961. Leading producers, supplying 82 percent of the tonnage, were Campbell Limestone Co., four quarries in Greenville, Pickens, and Spartanburg Counties; Palmetto Quarries Co., three quarries in Fairfield, Greenwood, and Richland Counties, and Weston & Brooker Co., Lexington County. Eighty-three percent of the crushed granite was used for concrete, road metal, and screenings; 8 percent for stone sand and other uses; 6 percent for railroad ballast; and 3 percent for riprap. Crushed granite was transported 72 percent by truck and 28 percent by rail.

Dimension granite was produced from five quarries operated by three companies in two counties. Winnsboro Granite Co., Rion, and Comolli Granite Co., with headquarters at Elberton, Ga., quarried granite in Fairfield County. Kershaw Granite Co., Kershaw, operated two quarries and Comolli Granite Co. one quarry in Kershaw County. Leading individual producers in Kershaw County were Winnsboro Granite Co., Kershaw Granite Co., and Comolli Granite Co. Dimension stone was used for building and monumental purposes.

Crushed limestone was produced from three quarries by three companies in two counties; the operators were Campbell Limestone Co., Cherokee County, Carolina Giant Division of Giant Portland Cement Co., and Ideal Cement Co., Dorchester County. Sixty-four percent of the limestone was used in the manufacture of cement, flux for foundries, and other uses; 19 percent was used for concrete, road metal, and screenings, and 17 percent was used for agricultural purposes, including fertilizer filler. Ninety percent was transported by truck and the remaining 10 percent by railroad. The Division of Geology, State Development Board, published the results of a study on the limestone resources in a part of the State.[6] In addition to a discussion of lime-bearing formations in the Coastal Plain, the industrial use of limestone, chemical specfications, and localities are given. Also presented are the results of holes drilled into the Santee limestone by the Division and many private concerns. Two hundred and fifty-two chemical analyses are included.

Vermiculite.—By value, vermiculite was the fifth leading commodity in South Carolina, and for the fourth consecutive year, the State ranked second in the Nation in crude ore production, exceeded only by Montana. For the second year output declined; tonnage decreased 14 percent and value 15 percent. Zonolite Co., the principal producer, mined crude ore in Laurens County and processed the material at its Kearney plant, near Enoree. Zonolite shipped the processed ore to its own exfoliating plant near Travelers Rest and to out-of-State exfoliating plants. American Vermiculite Co. mined crude ore in Laurens and Spartanburg Counties, and exfoliated the material at its own plant in the Enoree Area. Patterson Vermiculite Co., formerly mining and exfoliating in Laurens County, acquired property and began mining and processing vermiculite in

[6] Heron, S. D., Jr. Limestone Resources of the Coastal Plain of South Carolina. Div. of Geol., State Development Bd., Bull. 28, 1962, 128 pp.

Union County, near Cross Keys. The company added new equipment to an existing plant.

Late in the year, Zonolite Co. and W. R. Grace & Co. announced that a tentative agreement had been reached under which W. R. Grace & Co. would acquire the business and assets of Zonolite on the basis of an exchange of common stock. Final arrangements were subject to approval of the Board of Directors and stockholders of Zonolite and the Board of Directors of Grace. The transaction was expected to be completed in April 1963.

METALS

Ferroalloys.—Pittsburgh Metallurgical Co. Inc., near Charleston, Charleston County, operated an electric-arc furnace and produced ferrosilicon, ferrochromium, and ferrochromium silicon. Virginia-Carolina Chemical Corp., Charleston County, produced ferrophosphorus as a byproduct of elemental phosphorus furnace operations.

Zirconium.—Orefraction Minerals, Inc., located near Andrews, Georgetown County, a subsidiary of M & T Chemicals, Inc., New York, continued operating its zircon processing plant. The company produced granular and dry-milled zircon for the foundry, refractories, ceramic, and glass industries. Late in the year M & T Chemicals, Inc., announced that American Can Co. by merger had acquired 100 percent of the corporation's capital stock and M & T Chemicals, Inc., was operating as a wholly owned subsidiary. M & T Chemicals, Inc., acquired Orefraction Minerals in 1960.

MINERAL FUELS

Peat.—Production of peat increased 35 percent in quantity and 43 percent in value compared with decreases of 40 and 46 percent in 1961. Ti-Ti Peat Humus Co. Inc., Colleton County, produced reed-sedge peat for use as a soil conditioner. This was the only known peat operation in the State.

REVIEW BY COUNTIES

Mineral production was recorded in 28 of the 46 counties, 1 county more than in 1961. Dorchester, Aiken, and Fairfield Counties furnished 58 percent of the total mineral production value. The leading 10 counties all had output exceeding $1 million and furnished 86 percent of the total; they were Dorchester, Aiken, Fairfield, Lexington, Richland, Marlboro, Spartanburg, Pickens, Laurens, and Greenville. Seventeen counties reported no mineral production. Sand and gravel was produced in 22 counties, miscellaneous clay in 11, crushed granite in 8, vermiculite in 3, dimension granite, crushed limestone, and kaolin in 2, and barite, cement, crude feldspar, gem stones, kyanite, scrap mica, peat, pyrites, crushed sandstone, vermiculite in 1 county each.

Aiken.—For the seventh consecutive year, Aiken was the second most important mineral-producing county. Commodities produced were kaolin, and sand and gravel, both showing appreciable increases.

Kaolin produced at 15 mines by 9 companies, compared with 12 mines in 1961, increased in output 11 percent and in value 14 percent. Leading producers were J. M. Huber Corp. (Ideal, Barden, Parker, and Paragon mines), Dixie Clay Co. (McNamee mine) and National Kaolin Products Co. (Aiken County mine). Aiken County led the State in kaolin production. Kaolin was used for whiteware, art pottery, firebrick and block, saggers, pins, stilts and wads, other refractories, paper filling, paper coating, rubber, linoleum and oilcloth, paint, fertilizers, insecticides and fungicides, plaster and plaster products, other fillers, chemicals, exports, and miscellaneous uses. Sand and gravel production nearly trebled that of 1961. Perry Minerals Co. Inc. (Marine Minerals mine), a new producer Augusta Sand & Gravel Co. (Clearwater mine), and South Carolina State Highway Department (Aiken mine) mined sand and gravel for building, paving, and miscellaneous uses. Most of the material was transported by truck and a small percentage by railroad.

Anderson.—Interstate Materials Co. (Anderson quarry) crushed granite for concrete, roadstone, and screenings. The State highway department mined paving sand for its own use.

TABLE 7.—Value of mineral production in South Carolina, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value
Aiken	(2)	(2)	Kaolin, sand and gravel.
Anderson	(2)	(2)	Granite, sand and gravel.
Charleston	(2)	(2)	Sand and gravel.
Cherokee	$960,143	$872,996	Limestone, barite, sand and gravel, miscellaneous clay.
Chester	591	246	Sand and gravel.
Chesterfield	(2)	253,261	Do.
Colleton	(2)	(2)	Peat.
Dorchester	(2)	(2)	Cement, limestone, miscellaneous clay, sand and gravel.
Edgefield	(2)	10,096	Miscellaneous clay.
Fairfield	(2)	(2)	Granite, miscellaneous clay.
Florence	(2)	(2)	Sand and gravel.
Greenville	(2)	(2)	Granite, sand and gravel.
Greenwood	(2)	(2)	Granite, miscellaneous clay.
Horry	(2)	(2)	Sand and gravel.
Jasper	(2)	(2)	Do.
Kershaw	(2)	(2)	Sand and gravel, granite.
Lancaster	(2)	(2)	Mica, miscellaneous clay, sand and gravel.
Laurens	(2)	(2)	Vermiculite.
Lexington	(2)	(2)	Granite, sand and gravel, miscellaneous clay, gem stones.
Marion	(2)	(2)	Miscellaneous clay, sand and gravel.
Marlboro	(2)	(2)	Sand and gravel, miscellaneous clay.
Oconee	(2)	2,180	Sand and gravel.
Orangeburg	(2)	----------	
Pickens	(2)	(2)	Granite
Richland	(2)	(2)	Granite, kaolin, miscellaneous clay, sand and gravel.
Spartanburg	1,683,640	1,334,152	Granite, sandstone, feldspar, sand and gravel, vermiculite.
Sumter	(2)	(2)	Sand and gravel, miscellaneous clay.
Union	----------	(2)	Vermiculite, sand and gravel.
York	(2)	(2)	Kyanite, pyrites, sand and gravel.
Undistributed	[3] 28,729,626	31,428,069	
Total	[3] 31,374,000	33,901,000	

[1] The following counties are not listed because no production was reported: Abbeville, Allendale, Bamberg, Barnwell, Beaufort, Beckley, Calhoun, Clarendon, Darlington, Dillon, Georgetown, Hampton, Lee, McCormick, Newberry, Saluda, and Williamsburg.
[2] Figure withheld to avoid disclosing individual company confidential data ;included with "Undistributed."
[3] Revised figure.

Charleston.—Smith & Smith, Inc. (Edisto mine), formerly Edisto Sand & Gravel Co., and Sandrying Co. (North Charleston mine), mined sand for building purposes and as a fertilizer filler. Virginia-Carolina Chemical Co. and Pittsburgh Metallurgical Co. produced ferroalloys from electric furnace operations; Virginia-Carolina also produced byproduct gypsum as an uncalcined product for agricultural use. West Virginia Pulp & Paper Co. (Charleston limekiln), North Charleston, produced industrial quicklime for pulp and paper; this was the first year that this recirculated lime output has been reported.

Cherokee.—Cherokee County did not rank in the first 10 counties in mineral production value for the first time in several years. Industrial Minerals, Inc. (Kings Creek mine), mined barite; tonnage decreased but value increased slightly. Campbell Limestone Co. (Blacksburg quarry) crushed limestone for concrete aggregate, roadstone, and agstone. Broad River Brick Co. (Broad River mine) and Bennett Brick & Tile Co. (Kings Mountain mine) mined miscellaneous clay for heavy clay products; tonnage and value increased considerably. Jobe Sand Co. (Blacksburg mine) mined industrial sand and the State highway department (Cherokee County mine) mined paving sand.

Chester.—The State highway department mined a small tonnage of paving sand.

Chesterfield.—There were four commercial sand and gravel producers in 1962, compared with only two in 1961. Becker County Sand & Gravel Co. (Cash mine) mined construction sand and gravel; F. T. Williams (Pageland mine) mined building sand and Huneycut Bros. Sand & Gravel Co. (Chesterfield mine) and Charlotte Sand Co. (Mt. Crogan mine), both of Charlotte, N.C., and new producers, mined building sand. The State highway mined a small tonnage of paving sand for road maintenance purposes. Total county production was 2 percent below that of 1961. Seventy-seven percent was transported by truck and the remainder by railroad.

Colleton.—Ti-Ti Peat Humus Co. Inc., Green Pond, produced peat for use as a soil conditioner. Quantity and value increased 35 and 43 percent. This was the only mineral production reported in the county and the only known peat producer in the State.

Dorchester.—Dorchester County, for the seventh consecutive year, led in total value of mineral production; total value increased 6 percent. Carolina Giant Division of Giant Portland Cement Co., Harleyville, manufactured portland and masonry cements and produced miscellaneous clay and crushed limestone for use in cement. New records were established in both portland and masonry cement; portland cement increased 9 percent in quantity and 7 percent in value and masonry cement increased 30 and 31 percent. Miscellaneous clay and crushed limestone used in cement increased proportionately in output. The Agstone Division of Ideal Cement Co. (Carolina quarry) produced crushed limestone for agricultural purposes; output and value increased substantially. Salisbury Brick Corp. (Salisbury mine) mined miscellaneous clay for heavy clay products; tonnage increased 17 percent and value 21 percent. Deerfield Sand & Mining Co. (Ridgeland mine), Jasper, reporting for the

first year, and Murray Mines Division of Murray Mines Co., Summerville, produced building sand for construction purposes; all of the material was transported by truck.

Edgefield.—Merry Bros. Brick & Tile Co., the only mineral producer in the county, produced miscellaneous clay for heavy clay products.

Fairfield.—The county moved from eighth to third place in the State in value of mineral production. Rion Crushed Stone Corp. (Rion quarry) and Palmetto Quarries Co. (Blair quarry) produced crushed granite for concrete aggregate, roadstone, screenings, railroad ballast, stone sand, and poultry grit; total output and value increased considerably. Winnsboro Granite Co. (Winnsboro quarry), Rion, and Comolli Granite Co. (Mohogany quarry), Elberton, Ga., quarried rough dimension granite for the monumental and architectural stone industries. Richland Shale Products Co. (Richtex mine), Columbia, mined miscellaneous clay and shale for use in making heavy clay products, including tile.

Florence.—Coastal Sand Co. (Johnsonville mine) mined building, paving, and other construction sand. Lanford Sand Co. (Florence mine), reporting for the first year, mined building sand for construction purposes. All the material was transported by truck.

Georgetown.—International Paper Co. (Georgetown limekiln) produced industrial quicklime used in the manufacture of pulp and paper; this was the first year that this recirculated lime output was reported.

Greenville.—For the second consecutive year, Greenville County ranked 10th in mineral production value. Campbell Limestone Co. (Lakeside quarry) produced crushed granite for concrete, roadstone, screenings, riprap, and stone sand. W. M. Barber Sand Co. (Greenville mine), reporting for the first year, Zupan Sand Co. (Greenville mine), and Saluda Sand Co. (Garrison mine) mined building sand; output and value of the combined companies increased over that of 1961. All the sand was transported by truck. The State Highway department mined an increased tonnage of sand for use in road maintenance.

Greenwood.—Palmetto Quarries Co. (Stoney Point quarry) crushed granite for roadstone, concrete, screenings, and stone sand. Southern Brick Co. (Ninety-Six mine) and Angus Brick & Tile Co. (Ninety-Six mine) mined miscellaneous clay and shale for use in brick and tile.

Horry.—E. P. Pitts Sand Corp. (Pitts mine) produced glass sand for local and out-of-State use; all the sand was transported by railroad.

Jasper.—Deerfield Sand & Mining Co. (Deerfield mine), Ridgeland, produced building sand. The company also began mining sand in Dorchester County.

Kershaw.—Kershaw Granite Co. (Kershaw and Coral Gray quarries) and Comolli Granite Co. (Carolina Diamond Gray quarry) quarried rough dimension granite for monument and architectural uses; this was the first year that production from Kershaw's Coral Gray quarry was reported. Combined output and value of the three quarries increased considerably. Kershaw County Sand Co. (Camden mine) mined building and fill sand. Whitehead Bros. Co. (Lugoff

mine) produced industrial sand; all of the sand was transported by railroad. Mineral Mining Corp. ground scrap mica from Lancaster County deposits at its Kershaw grinding plant.

Lancaster.—Mineral Mining Corp. (Kershaw Strip mine) recovered scrap mica from a mica schist deposit. The material was dry-ground and used in the manufacture of paint, plastics, pipeline enamel, welding rods and electrical insulation; tonnage and value increased over that of 1961. Ashe Brick Co. (Van Wyck mine) mined miscellaneous clay for the manufacture of building brick at its own plant; tonnage was about the same as that in 1961 but value increased. The State highway department mined 2,000 tons of paving sand for use in its road maintenance program.

Laurens.—Laurens County ranked ninth in value of mineral production, dropping from fifth place in 1961. In vermiculite production, South Carolina ranked second in the Nation and most of the material was mined and processed in the Enoree Area of the county. Zonolite Co. (Enoree Area mines) was the largest producer of crude vermiculite; output and value was below that of 1961. Zonolite mined and processed crude ore and shipped processed material to its exfoliating plant at Travelers Rest and to out-of-State exfoliating plants. American Vermiculite Co. (Donnon mine and plant) mined crude vermiculite and exfoliated the material at its own plant. Patterson Vermiculite Co., formerly operating in the Enoree Area, lost its exfoliating plant by a fire late in 1961, and moved to a new location in Union County.

Lexington.—Lexington County was in fourth place in value of mineral production, moving from sixth place in 1961. Commodities produced were crushed granite, miscellaneous clay, sand and gravel, and a small amount of gem material. Weston & Brooker (Cayce quarry) crushed granite for concrete, roadstone, screenings, railroad ballast, and stone sand; output and value showed a moderate increase. Guignard Brick Co. (Columbia mine) mined miscellaneous clay for use in manufacturing building brick at its own plant in the Columbia Area. Sand was mined by four commercial producers and one noncommercial operation. Columbia Silica Sand Co. (Edmund mine), Foster Bros. Dixiana Sand Co. (Dixiana mine), mined building and industrial sands for a variety of uses; Pennsylvania Glass Sand Corp. (Columbia mine), a new producer, began operations in March, and mined industrial sand and processed ground sand at its Columbia plant for various uses. Capital Sand Co. (Capital mine) mined paving sand, and the State highway department produced paving sand for use in its highway maintenance program. Total sand and gravel tonnage increased 19 percent and value nearly doubled that of 1961; 47 percent of the material was transported by truck and the remainder by railroad. Frank L. Sims, West Columbia, collected a small amount of quartz, classified as mineral specimens, from an unknown source in the county.

Marion.—J. D. Murchison (Pee Dee mine) produced miscellaneous clay for use in the manufacture of building brick. Sandy Bluff Sand Co. (Snipes mine), Mullins, produced building sand for the first time since 1960.

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Marlboro.—For the fourth consecutive year, Marlboro County was the first in rank in sand and gravel, third in miscellaneous clay output, and in 1962 moved from ninth to sixth place in total value of mineral production. Becker County Sand & Gravel Co., the largest sand and gravel producer in the State, mined construction and industrial sand and construction gravel at its Marlboro mine; output and value increased over that of 1961. Lawrence Stone & Gravel Co. (Blenheim mine) did not report any production for the year. Palmetto Brick Co. (Irby mine) and Cheraw Brick Works, Inc. (Cheraw mine), mined miscellaneous clay for use in manufacturing building brick; combined output and value increased.

Oconee.—The State highway department mined paving sand for use in its highway maintenance program. J. L. Colville Construction Co. (Colville quarry) closed its quarry upon completion of its contract to supply riprap for the Hartwell Dam project.

Orangeburg.—J. F. Cleckley & Co. closed its Orangeburg sand mine, and no production from any other source in the county was reported.

Pickens.—The county ranked eighth in value of mineral production, dropping from seventh place in 1961. Campbell Limestone Co., the largest crushed granite producer in the State, mined granite for riprap, concrete, roadstone, screenings, and stone sand from its Beverly quarry. This was the only producer in the county reporting mineral production.

Richland.—The county, having been fourth in mineral production value for two consecutive years, dropped to fifth place. The county ranked second in refractory kaolin and miscellaneous clay production, exceeded only by Dorchester. Richland also was an important sand producing county. Palmetto Quarries, Inc. (Columbia quarry), crushed granite for concrete, roadstone, screenings, railroad ballast, and stone sand. Refractory kaolin was produced by Carolina Ceramics, Inc. (Pontiac mine), for firebrick and fire block, fire-clay mortar, and other refractories; the company also produced miscellaneous clay for heavy clay products. D. T. Duncan, a new kaolin producer reporting for the first year, mined refractory clay for heavy clay products. Columbia Pipe Co. (Ridgewood mine), Eastern Brick & Tile Co. (601 mine), and R. M. Stork Fire Brick Works (Stork mine) produced refractory kaolin for firebrick and fire block, architectural terracotta, fire-clay mortar, and other uses. Columbia Brick & Tile Co. (Columbia mine) mined miscellaneous clay for heavy clay products. Strickland Sand Co. (Columbia mine) produced building and fill sand; Harrison Sand Corp. (Harrison mine) produced construction and industrial sand.

Spartanburg.—Spartanburg County, ranking third for five consecutive years in mineral production value, dropped to seventh place. Campbell Limestone Co. (Pelham and Pacolet quarries) crushed granite for concrete, roadstone, screenings, riprap, and railroad ballast. The company was the largest mineral producer in the county. Campbell Limestone supplied granite screenings from its Pacolet quarry to Spartan Minerals Co., formerly Paco Products, Inc. Spartan produced crude feldspar, ground feldspar, and a silica product from the screenings; the material was used locally and

shipped out-of-State for use in ceramics, glass, and other uses. American Vermiculite Co. (Propst mine) mined crude vermiculite and trucked the material to its own exfoliating plant in Laurens County. Zonolite Co. operated an exfoliating plant at Travelers Rest, using vermiculite from its nearby Enoree Area mines in Laurens County.

Sumter.—The county has been the third largest sand and gravel producing county for three consecutive years. Becker County Sand & Gravel Co. (Camden mine) mined construction sand used for buildings, paving, and railroad ballast uses, and construction gravel used for building and paving purposes. Eastern Brick & Tile Co. (Wedgefield mine), reporting production for its second year, mined miscellaneous clay used in the manufacture of building brick.

Union.—Patterson Vermiculite Co. (Union County mine), formerly operating in Laurens County, mined crude vermiculite from a deposit located near Cross Keys for the first year. The State highway department mined a small tonnage of paving sand used for its highway maintenance program. This was the first year that mineral production was reported in this county.

York.—Commercialores, Inc. (Henry Knob mine), the only kyanite and pyrite producer in the State, mined kyanite ore and produced kyanite for use in firebrick, tile, and other uses, and for the third year recovered pyrite as a byproduct of milling kyanite ore. Bowater Carolina Corp. (Catawba limekiln), produced quicklime for the manufacture of paper and pulp; this was the first year that this recirculated lime production has been reported. The State highway department mined paving sand for use in its highway program.

The Mineral Industry of South Dakota

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the South Dakota State Geological Survey for collecting information on all minerals except fuels.

By Carl L. Bieniewski [1] and Allen F. Agnew [2]

MINERAL production in South Dakota was valued at $45.8 million, an increase of $1.8 million or 4 percent over that of 1961, thereby reversing the downward trend in total value that started in 1960. The State was again the leading producer of gold and hand-cobbed beryl in the Nation.

Nineteen commodities were produced and sold during the year; the only new commodity produced and sold, compared with those of last year, was lithium minerals. Gold, sand and gravel, cement, and stone accounted for 95 percent of the State total value of mineral output. Production of nonmetals as a group amounted to $24.4 million or 53 percent of the total; metals, $20.9 million or 46 percent; and fuels, $0.4 million or 1 percent. Increases of 10 percent or more in value of production were reported for sand and gravel, lime, and iron ore; decreases of 10 percent or more were reported for mica, vanadium, beryllium concentrate, petroleum, and uranium ore.

[1] Mining engineer, Bureau of Mines, Denver, Colo.
[2] State geologist, South Dakota State Geological Survey, Vermillion, S. Dak.

TABLE 1.—Mineral production in South Dakota [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Beryllium concentrate---short tons, gross weight	238	$130	144	$77
Cement---thousand 376-pound barrels	(2)	(2)	2,360	7,566
Clays---thousand short tons	[3] 249	[3] 249	249	690
Coal (lignite)---do	18	75	18	77
Feldspar---long tons	29,354	186	29,697	191
Gem stones	(4)	18	(4)	20
Gold (recoverable content of ores, etc.)---troy ounces	557,855	19,525	577,232	20,203
Gypsum---thousand short tons	22	89	23	93
Iron ore (usable)---thousand long tons, gross weight	22	100	34	113
Lead (recoverable content of ores, etc.)---short tons	(5)	(6)	3	1
Mica:				
Scrap---do	1,054	32	210	6
Sheet---pounds	18,086	37	2,085	12
Petroleum (crude)---thousand 42-gallon barrels	233	(2)	[7] 170	(2)
Sand and gravel---thousand short tons	11,324	7,336	15,371	9,207
Silver (recoverable content of ores, etc.) thousand troy ounces	127	118	113	123
Stone---thousand short tons	2,806	6,642	2,852	6,533
Uranium ore---short tons	43,588	495	29,452	370
Value of items that cannot be disclosed: Clays (bentonite, 1961), lime, lithium minerals (1962), vanadium, and values indicated by footnote 2	----------	[8] 8,975	----------	507
Total	----------	[8] 44,007	----------	45,789

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Excludes bentonite; included with "Value of items that cannot be disclosed."
[4] Weight not recorded.
[5] Less than 0.5 ton.
[6] Less than $500.
[7] Preliminary figure.
[8] Revised figure.

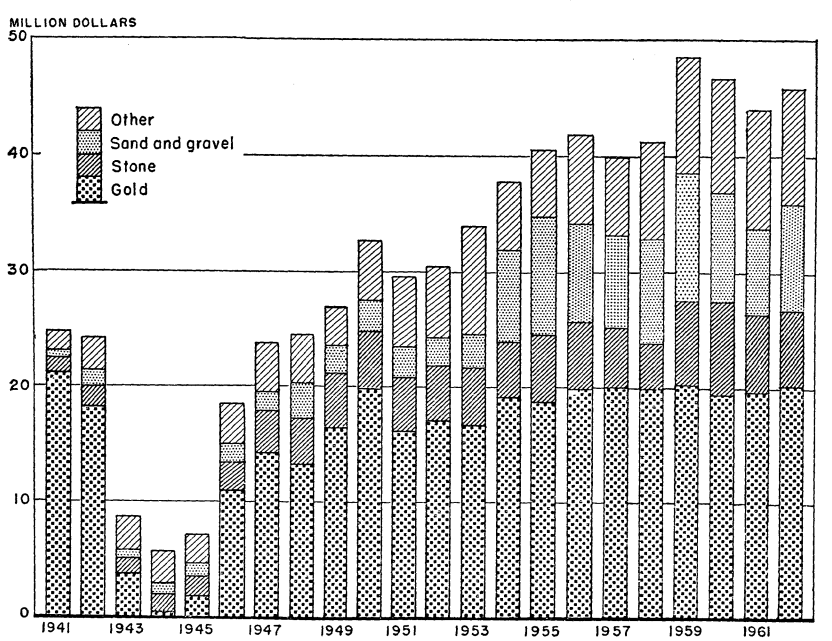

FIGURE 1.—Value of gold, dimension and crushed stone, sand and gravel, and total value of mineral production in South Dakota, 1941–62.

Mineral output was reported from 60 of the State's 67 counties. The combined value of mineral production in Lawrence and Pennington Counties was $31.6 million, or about two-thirds of the total value of the State's mineral output. Grant and Minnehaha Counties each reported production valued at over $1 million.

Employment and Injuries.—Final data for 1961 and preliminary data for 1962 compiled by the Bureau of Mines for employment and injuries in the South Dakota mineral industries, excluding the petroleum industry, are shown in table 2.

TABLE 2.—Employment and injuries in the mineral industries [1]

Industry	Number of operations	Average number of men employed	Total man-hours worked	Injuries		Frequency rate (injuries per million man-hours)
				Fatal	Nonfatal	
1961:						
Metal mines and mills (excluding uranium)	55	1,831	4,403,145	1	60	13.9
Uranium mines and mills	23	104	204,216	----------	10	49.0
Nonmetal mines and mills (other than sand and gravel and stone)	87	221	321,304	1	5	18.7
Stone quarries and plants	74	548	1,057,126	----------	24	22.7
Sand and gravel plants	209	1,496	1,960,180	----------	38	19.4
Coal mines	2	9	11,964	----------	----------	----------
Total	450	4,209	7,957,935	2	137	17.5
1962: [2]						
Metal mines and mills (excluding uranium)	22	1,793	4,359,615	6	55	14.0
Uranium mines and mills	20	103	202,062	----------	16	79.1
Nonmetal mines and mills (other than sand and gravel and stone)	46	227	328,841	1	5	18.2
Stone quarries and plants	73	480	1,002,406	1	21	21.9
Sand and gravel plants	192	1,208	1,870,171	----------	7	3.7
Coal mines	1	8	12,096	----------	----------	----------
Total	354	3,819	7,775,191	8	104	14.4

[1] Excludes employees in the petroleum industry as well as officeworkers.
[2] Preliminary figures.

Government Programs.—Domestic mica and beryl purchasing programs of the Federal Government, started in 1952, were terminated in June. During the programs, the General Services Administration (GSA) purchased 2,655 tons of hand-cobbed beryl and 2,225 tons of hand-cobbed mica at its Custer depot. According to records of the Bureau of Mines, 76 percent of the beryl, valued at $1 million, and 44 percent of the mica, valued at $0.7 million, came from deposits within the State.

The U.S. Atomic Energy Commission (AEC) and Mines Development, Inc., signed a new contract on March 19 for the purchase of uranium concentrate produced in the company mill at Edgemont. The new contract—retroactive to September 1, 1961—extending through December 31, 1966, replaced an earlier contract which would have expired at the end of March. Under the new agreement, AEC paid $8.45 per pound for uranium oxide (U_3O_8) purchased before April 1 and $8.00 per pound for U_3O_8 purchased during the remaining life of the contract. The maximum delivery rate, unless increased by in-

dependent production, was established at 700,000 pounds of U_3O_8 per fiscal year before September 1, 1963, and 650,000 pounds of U_3O_8 per fiscal year thereafter.

The Office of Minerals Exploration (OME) did not enter into any new contracts for mineral exploration in the State, and no OME contracts were in force during the year.

Receipts from bonuses, rentals, and royalties for the year from State mineral land totaled $170,398. In addition, the State received U.S. Department of the Treasury checks totaling $91,853 as its share in bonuses, rentals, and royalties from mineral leasing of Federal land within the State.

Superheater difficulties at the Pathfinder atomic powerplant, a cooperative project of AEC and Northern States Power Co., prevented the reactor from reaching criticality this year. The 62,000-kilowatt plant near Sioux Falls was not expected to begin operation until late 1963.

A large part of the output of cement, crushed stone, and sand and gravel was required for construction financed by Federal, State, county, and municipal funds. During 1962, contracts totaling $34.5 million [3] were awarded for highway construction in the State. A 46-percent increase in highway work was planned for 1963. Highlighting the road work completed during 1962 was the addition of 55 miles [4] of new interstate highways. This addition brought the number of miles open to traffic in this system to 223 miles, or about one-third of the 679 miles designated for the State.

Construction on the Oahe dam project was virtually completed. Dedication services of this dam took place on August 17. Work progressed throughout the year on the Big Bend dam project. The last of the Intercontinental Ballistic Missile sites under construction in the State was nearing completion at yearend.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Cement production statistics for the State are published this year for the first time. The previous method of reporting national cement figures prevented publication of data for South Dakota.

Shipments from the only cement plant, which is the State-owned plant in Rapid City, were less than those of 1961. The drop in shipments was caused partly by the Chicago & North Western Railway Co. strike during the summer, which caused the loss of some cement orders because rail transportation was unavailable. Some heavy-construction projects, such as building of missile sites and dams, were completed or were at a stage that required smaller quantities of cement than those of last year. The cement plant was operated at 88 percent of capacity.

Portland cement sales represented 98 percent and masonry cement 2 percent of the cement shipments, the same as in 1961. Portland

[3] Engineering News-Record. Road Contractors Will Set a Record. V. 170, No. 16, Apr. 18, 1963, pp. 21–24.
[4] Bureau of Public Roads. Quarterly Report on the Federal-Aid Highway Program, Dec. 31, 1962. Press release BPR 63–10, Feb. 10, 1963.

cement sold for $3.18 per barrel (376 pounds), and masonry cement for $3.30 per barrel (280 pounds), compared with $2.91 and $2.90, respectively, in 1961. Out-of-State shipments of portland and masonry cements were made to Minnesota, Montana, Nebraska, North Dakota, and Wyoming. Small quantities of portland cement were shipped to Ohio and Washington.

The South Dakota Cement Commission postponed establishing a cement distribution center at Wolsey.

Clays.—The quantity and value of clays produced were less than those of 1961. American Colloid Co., the only bentonite producer, mined bentonite west of Belle Fourche. The main uses for this bentonite were as a refractory material in foundries and a rotary drilling mud for oil well drilling. The company did not renew a 5-year lease for mining bentonite on State land west of Belle Fourche; the lease had been acquired March 1, 1957. Only a small quantity of bentonite was mined during the life of the lease.

Miscellaneous clay was produced by Black Hills Clay Products Co. for making brick; by Lightweight Aggregates, Inc., for making lightweight aggregate; and by the South Dakota Cement Commission as raw material for cement.

Feldspar.—There was no appreciable change in the output of crude feldspar. The production came from 49 mines, whereas in 1961, it came from 56 mines. Seven of the mines operated were in Pennington County and 42 in Custer County. Major operators, who produced 1,000 long tons or more, were Royce McRobbie (Albino No. 1 mine), Charles Stiles (Beck), Ray Wineteer & Everett Yanda (St. Louis), International Minerals and Chemical Corp. (IMC) (Shamrock), Fred Tubbs (Tip Top), and Briggs Manufacturing Co. (White Elephant). Output from these six mines accounted for 81 percent of the State total production of feldspar.

Most of the crude feldspar produced was ground at the IMC plant at Custer. The ground feldspar was used by manufacturers of porcelain, pottery, glass, enamel, brick and tile, and insulation in more than 17 States and 2 foreign countries.

Gem Stones.—The value of gem material increased $2,000 or 11 percent above that of 1961. Agate and rose quartz were the most popular gem materials collected; other gem materials collected were petrified wood, jasper, chert, gypsum, and iron pyrites. Most of the gem material came from Custer and Pennington Counties.

Gypsum.—Gypsum produced at the South Dakota Cement Commission pit near Rapid City was used as a retarder in portland cement. Although the production was 1,000 short tons greater than in 1961, consumption was 7,000 tons less because of the decrease in portland cement production at the cement plant. The balance of the production was stockpiled at the cement plant.

Lime.—Output of lime was 14 percent greater than that of 1961. The increase was due to the need for more quicklime by Utah-Idaho Sugar Co. at its Belle Fourche sugar beet mill to process a larger crop of sugar beets. The company produced the quicklime at the plant from limestone purchased from Cole Construction Co. Quicklime also was produced by Black Hills Lime Co. and used for metallurgical purposes.

A new firm, Rapid City Lime Co., announced plans to build a 150-ton-per-day lime plant adjacent to the Pete Lien & Sons limestone quarry at Rapid City. Most of the equipment to be used in the plant was to come from a plant located in Colton, Calif. Pete Lien & Sons, who were to lease the plant after construction, expected to be in production by the fall of 1963.

Lithium.—IMC sold some lithium ore that had been mined and stockpiled from the Hugo Lode mine before 1962. The Tin Mountain mine, operated by Clifford & Chord, was the only other source of lithium ore sold during the year.

Mica.—Output of sheet mica was 88 percent less and of scrap mica 80 percent less than in 1961. There were 8 active mica operations, compared with 21 last year. The considerable decline in production and mining operations partly resulted from the termination of the Government domestic mica purchasing program in June. The mica receiving and processing depot at Custer closed down after 10 years of continual operation. The last sack of sheet mica was handled by the processing contractor, George Campbell, on November 5.

The scrap mica output was sent to grinding plants in California and Illinois. The ground mica was used in manufacturing paint and roofing materials.

TABLE 3.—Production of hand-cobbed mica and yield of sheet mica

Year	Hand-cobbed mica	Total block mica recovered		Stained quality recovered		Good stained and better quality recovered	
	Pounds	Pounds	Percent of hand-cobbed	Pounds	Percent of total block	Pounds	Percent of total block
1958	257,198	16,681	6.49	9,552	57.26	471	2.82
1959	365,712	38,734	10.59	20,079	51.84	601	1.55
1960	286,043	30,887	10.80	18,662	60.42	461	1.49
1961	83,381	7,086	8.50	4,994	70.48	214	3.02
1962	25,680	2,085	8.12	1,597	76.59	22	1.06

TABLE 4.—Mica sold or used by producers

Mica	1958	1959	1960	1961	1962
Hand-cobbed, total:[1] pounds	257,198	365,712	286,043	83,381	25,680
Sheet:					
Full-trimmed:					
Pounds	94	41			
Value	$1,393	$593			
Average per pound	$14.82	$14.46			
Punch and washer:[2]					
Pounds				11,000	
Value				$300	
Average per pound				$.03	
From hand-cobbed:[1]					
Pounds	16,678	38,734	30,887	7,086	2,085
Value	$66,489	$157,234	$145,154	$37,040	$12,060
Average per pound	$3.99	$4.06	$4.70	$5.23	$5.78
Total:					
Pounds	16,772	38,775	30,887	18,086	2,085
Value	$67,882	$157,827	$145,154	$37,340	$12,060
Average per pound	$4.05	$4.07	$4.70	$2.06	$5.78
Scrap:					
Short tons	1,003	158	205	1,054	210
Value	$24,241	$4,916	$9,748	$32,122	$5,710
Average per ton	$24.17	$31.11	$47.55	$30.48	$27.19
Total sheet and scrap:					
Short tons	1,011	177	220	1,063	211
Value	$92,123	$162,743	$154,902	$69,462	$17,770

[1] Sold to the Government through GSA.
[2] Sold to industry.

Sand and Gravel.—Production of sand and gravel increased 36 percent in quantity and 26 percent in value over that of 1961. The increase was mainly the result of 3.6 million short tons of additional sand and gravel used for paving. Ninety percent of the total output was used for road construction (including road base, surface, and bridges), emphasizing the importance of this market to the sand and gravel industry of the State. Building construction accounted for 5 percent and fill for 4 percent of the total output. The remaining 1 percent was used as railroad ballast, molding sand, blasting sand, and sand for use in the hydrafrac process for recovering oil and gas. Government-and-contractor producers accounted for three-fourths and commercial for one-fourth of the total output in the State.

No sand and gravel production was reported for 9 (Bennett, Edmunds, Hughes, McCook, Shannon, Stanley, Todd, Tripp, and Washabaugh) of the 67 counties. Pennington County, the leading producer of sand and gravel, with 1.4 million tons output, was the only county in the State to have an output exceeding 1 million tons. Big Horn Construction Co., Dave Gustafson & Co., Inc., G. H. Lindekugel & Sons, Inc., Tennefos Construction Co., and Weelbarg Bros. each produced between 500,000 and 1 million tons of sand and gravel. The combined output of the five operators was 3.6 million tons, or about one-quarter of the State output. Each of 26 operators, including the 5 above, produced more than 100,000 tons of sand and gravel.

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	502	$583	527	$510
Paving	255	220	163	167
Railroad ballast	(1)	(1)		
Fill	13	7	11	5
Molding	(1)	(1)	(1)	(1)
Blast	(1)	(1)	(1)	(1)
Oil (hydrafrac)	(1)	(1)	(1)	(1)
Other	17	53	18	58
Total	787	863	719	740
Gravel:				
Construction:				
Building	109	160	139	201
Paving	2,961	1,813	2,855	1,677
Railroad ballast	62	59	45	33
Fill	97	49	40	24
Other	20	22	12	8
Miscellaneous	89	74	22	15
Total	3,338	2,177	3,113	1,958
Total sand and gravel	4,125	3,040	3,832	2,698
Government-and-contractor operations:				
Sand:				
Building	125	88		
Paving	594	494	662	509
Fill			10	9
Total	719	582	672	518
Gravel:				
Building			95	85
Paving	6,480	3,714	10,165	5,515
Fill			607	391
Total	6,480	3,714	10,867	5,991
Total sand and gravel	7,199	4,296	11,539	6,509
All operations:				
Sand	1,506	1,445	1,391	1,258
Gravel	9,818	5,891	13,980	7,949
Grand total	11,324	7,336	15,371	9,207

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

TABLE 6.—Sand and gravel production in 1962, by counties
(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Aurora	75	$32	Jackson	122	$68
Beadle	154	77	Jerauld	28	14
Bon Homme	279	116	Jones	15	8
Brookings	520	290	Kingsbury	577	289
Brown	421	265	Lake	180	114
Brule	95	47	Lawrence	248	138
Buffalo	140	61	Lincoln	262	178
Butte	238	158	Lyman	153	77
Campbell	(1)	(1)	McPherson	136	72
Charles Mix	303	157	Marshall	440	278
Clark	374	195	Meade	850	424
Clay	61	32	Mellette	83	43
Codington	474	346	Miner	(1)	(1)
Corson	225	171	Minnehaha	932	612
Custer	231	118	Moody	276	149
Davison	171	99	Pennington	1,397	939
Day	254	130	Perkins	309	171
Deuel	216	100	Potter	59	30
Dewey	88	24	Roberts	466	267
Douglas	103	63	Sanborn	14	9
Fall River	147	111	Spink	378	231
Faulk	310	182	Sully	61	13
Grant	26	13	Turner	494	344
Gregory	158	123	Union	89	45
Haakon	236	126	Walworth	146	116
Hamlin	71	65	Yankton	146	77
Hand	129	64	Ziebach	148	76
Hanson	61	31	Undistributed	1,393	1,032
Harding	147	74			
Hutchinson	189	77	Total	15,371	9,207
Hyde	73	46			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Stone.—Production of stone was virtually the same as that of 1961. Granite, limestone, quartzite, and slate were the definite types of stone produced. Miscellaneous stone not identified as to type was produced in 27 counties. Fifty-nine percent of the total stone production was used in concrete and as road material; 21 percent in cement; 11 percent as riprap; 6 percent as railroad ballast; and the remaining 3 percent as filler, refractory material, dimension stone, and raw material for producing lime. Fifty-eight stone operations, five more than those of last year, were active in the State. Concrete Materials Co., Hills Materials Co., L. G. Everist, Inc., Pete Lien & Sons, South Dakota Cement Commission, and Spencer Quarries, Inc., accounted for 89 percent of the output of stone.

Although the quantity of dimension granite quarried was only about 15,000 short tons, the value ($2.4 million) was appreciable, being 37 percent of the value of all the stone produced during 1962. From quarries in Grant County, six companies produced dimension granite in rough and dressed blocks for use as building stone and monuments. Quantity and value of dimension granite were each 14 percent below those of 1961. Dimension limestone, the first of such production since 1957, was used for rough building stone and rubble.

TABLE 7.—Stone sold or used by producers, by kinds

Year	Granite		Limestone		Sandstone [1]	
	Short tons	Value	Short tons	Value	Short tons	Value
1958	18,696	$2,097,262	878,500	$1,232,400	424,400	$692,000
1959	18,568	3,065,502	1,599,521	2,331,485	914,800	1,657,900
1960	17,915	3,002,488	1,578,618	2,501,216	1,031,524	1,855,179
1961	26,476	2,823,441	1,378,062	1,939,293	984,512	1,493,464
1962	25,923	2,442,181	1,572,300	2,184,374	1,119,655	1,779,639

Year	Other stone		Total	
	Short tons	Value	Short tons	Value
1958	73,600	$73,600	1,395,196	$4,095,262
1959	187,696	187,696	2,720,585	7,242,583
1960	520,945	550,469	3,149,002	7,909,352
1961	417,391	385,953	2,806,441	6,642,151
1962	[2] 134,056	[2] 126,373	2,851,934	6,532,567

[1] Includes quartz and quartzite.
[2] Includes slate.

TABLE 8.—Stone sold or used by producers, by uses

Use	1961		1962	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble, short tons			(1)	(1)
Rough architectural, cubic feet	(1)	(1)	(1)	(1)
Dressed architectural, do	(1)	(1)	(1)	(1)
Rough monumental, do	(1)	(1)	(1)	(1)
Dressed monumental, do	[2] 145,194	$2,380,436	[3] 122,572	$1,644,297
Flagging, do			(1)	(1)
Other, do	[4] 75,897	427,653	[5] 93,295	800,634
Total (approximate, in short tons)	17,908	2,808,089	18,457	2,444,931
Crushed and broken stone:				
Riprap, short tons	365,771	418,089	313,753	404,891
Railroad ballast, do	(1)	(1)	183,280	234,302
Concrete and roadstone, do	1,673,894	2,306,037	1,693,440	2,479,787
Cement, do	575,191	862,787	593,557	890,335
Other, do	[6] 173,677	[6] 247,149	[7] 49,447	[7] 78,321
Total, do	2,788,533	3,834,062	2,833,477	4,087,636
Total stone (approximate, in short tons)	2,806,441	6,642,151	2,851,934	6,532,567

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Approximately 11,761 short tons.
[3] Approximately 9,926 short tons.
[4] Approximately 6,147 short tons.
[5] Approximately 8,531 short tons.
[6] Includes stone used in lime, refractory, filler, roofing and decorative gravel, filter blanket, and railroad ballast.
[7] Includes stone used in filler, lime, and refractory.

METALS

Beryllium.—Termination of the Government beryl purchasing program in June adversely affected the output of beryl; production decreased 94 tons or 40 percent below that of 1961. No favorable market existed after June. Beryl was produced at only 27 mines compared with 65 in 1961.

Although production was far below that of 1961, the State still retained its position as the leading producer of hand-cobbed beryl in the Nation. The State output of beryl averaged 10.84 percent beryllium oxide (BeO).

Hough & Judson again produced over 100,000 pounds of beryl from a single property (the Hugo Lode), an accomplishment reported only twice previously in the history of beryl mining within the State. Peerless mine (two operators—Northwest Beryllium Co. and Newlon & Cordes), Tin Mountain (Walter S. Clifford), Beecher No. 1 (Arthur H. Lyndoe), and Etta (Walter S. Clifford) each produced between 10,000 and 100,000 pounds. Fourteen mines had production between 1,000 and 10,000 pounds, and 8 had less than 1,000 pounds.

Gold and Silver.—Production of gold accounted for 44 percent of the total value of minerals. Output increased 19,377 ounces or 3 percent over that of 1961. Silver production decreased 14,000 ounces or 11 percent below that of 1961. The price of silver increased during 1962, and as a result the value of the recovered silver was $5,000 or 4 percent greater than that of last year.

The Homestake Mining Co. mine at Lead continued to be the Nation's largest gold producer; again the output was sufficient to make South Dakota the leading gold-producing State. The 1.87 million short tons of ore milled established a new high in production, surpassing the previous company record set last year by 88,000 tons. The value of the recovered gold and silver per ton of ore was $10.85 or $0.15 less than that of 1961. However, because more ore was mined and the price of silver increased, value of the bullion was about $681,000 more than that of last year. This value, $20.3 million, was an alltime high for the mine; the previous high was $20.1 million in 1959.

Some gold and silver was recovered from lead ore mined at the Silver Queen property of Hage Bros., Inc.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)		Total value (thousands)
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)	
1953–57 (average)	2	--	1,654	548,590	$19,201	143	$129	[2] $19,330
1958	3	--	1,824	570,830	19,979	153	138	20,117
1959	2	--	1,778	577,730	20,221	124	113	20,334
1960	2	--	1,767	554,771	19,417	108	98	[3] 19,515
1961	2	--	1,781	557,855	19,525	127	118	[4] 19,643
1962	2	--	1,869	577,232	20,203	113	123	[5] 20,326
1876–1962	(6)	(6)	(6)	29,385,994	810,107	11,758	8,798	[7] 819,070

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore or old tailings shipped directly to smelters during the calendar year indicated.
[2] Includes 10 short tons of lead valued at $2,620 in 1953.
[3] Includes 1 ton of copper valued at $642.
[4] Includes less than 0.5 ton of lead valued at $52.
[5] Includes 3 tons of lead valued at $552.
[6] Data not available.
[7] Includes 107 short tons of copper valued at $37,108, 500 tons of lead valued at $72,356, and 265 tons of zinc alued at $56,406.

Iron Ore.—Pete Lien & Sons mined iron ore from the Dungey Bog and Painter pits located in the Rochford district. The South Dakota Cement Commission purchased the output and placed it in a stockpile at the cement plant for use in making certain types of cement. The 1962 purchases completed the plant iron-ore stockpile program in effect since 1960.

A positive magnetic anomaly was found in the southeast corner of the State by the South Dakota State Geological Survey magnetometer crew. The anomaly, known as the Willowdale magnetic high, was in the same general area as the Spink anomaly discovered in 1961. The State Geological Survey planned to put down a core hole on the newly discovered anomaly in the spring of 1963. The unaltered rock of the core obtained from a hole on the Spink anomaly assayed 14.5 percent ferric oxide (Fe_2O_3) and 6.8 percent titanium dioxide (TiO_2), and the altered rock assayed 13.6 percent Fe_2O_3 and 3.6 percent TiO_2. The unaltered rock contained magnetite and the altered rock hematite.

Lead.—The Silver Queen mine, operated by Hage Bros., Inc., was again the only source of lead production in the State. The ore was shipped to the American Smelting and Refining Co. lead smelter at East Helena, Mont.

Uranium Ore.—Although the number of uranium operations increased from 27 to 29, production of uranium ore was 32 percent less than that of 1961. The average grade of the ore shipped was 0.18 percent uranium oxide (U_3O_8), 0.01 percent higher than that of 1961. Walter Wilk shipped a small quantity of ore from a mine in Pennington County, a mine that had been inactive since 1957. Other shippers were F. J. & F. Albright, Bettenhausen & Wheeler, Black Hills Uranium Co., Earl Boner, Roy E. Chord, Chord Uranium Co., Ray Fay, Walter L. McKenna, Wayne Sundstrom, and Susquehanna-Western, Inc.

The outlook for mining and treating the uranim-bearing lignite in the Cave Hills and Slim Buttes areas dimmed considerably when International Resources Corp. announced in January that it had abandoned plans to build a uranium processing mill to handle the material. Kermac Nuclear Fuels Corp. and Susquehanna-Western, Inc., later became interested in this material. In the fall, Kermac mined material from deposits in the Cave Hills area and stockpiled it on a property near Riley Pass in the same area. Starting in September, Susquehanna-Western purchased uranium-bearing lignite mined by independent producers from deposits in the Cave Hills and Slim Buttes areas. The purchased lignite was stockpiled next to the company buying station at Buffalo. Both companies planned to burn the lignite and ship the ash to a uranium mill for processing. Production of the uranium-bearing lignite was not to be reported until it was accepted at a uranium mill.

Vanadium.—Production of vanadium oxide (V_2O_5) was one-half that of 1961. The decrease was attributed to a lower V_2O_5 content in the uranium ores shipped and a reduction in the quantity of vanadium-bearing uranium ores shipped. The ores averaged 0.123 percent V_2O_5, whereas last year, they averaged 0.153 percent V_2O_5. The V_2O_5 was recovered from the ores treated at Mines Development, Inc., uranium mill at Edgemont.

MINERAL FUELS

Coal (Lignite).—Output of coal (lignite) was the same as that of 1961; however, because of a price increase of 10 cents per ton, the value was 3 percent greater. The reported production, excluding mines producing less than 1,000 short tons, came from the strip mine operated by Dewey County Coal Co. near Firesteel in Dewey County.

Petroleum.—Petroleum (crude) production continued to decline; the output was 63,000 barrels (27 percent) less than that of 1961. Nineteen wells, the same as in 1961, were active in the Buffalo field. The one well active in 1961 in the Barker Dome field did not produce in 1962.

The 11 exploratory wells drilled during the year were dry holes—4 in Custer, 3 in Fall River, and 1 each in Butte, Brule, Pennington, and Tripp Counties. Total footage of the 11 wells was 28,110 feet. The depths drilled varied from 1,803 feet to 3,420 feet. One well in Fall River County, redrilled and deepened to a depth of 2,545 feet, also was a dry hole.

Early in November, Zapata Petroleum Corp. (a Texas firm) purchased the Shell Oil Co. holdings in the Buffalo field area. The holdings included 13 producing wells and leases on approximately 18,000 acres, plus production equipment such as pumps and storage tanks.

On October 15, Wyco Pipe Line Co. started constructing a 189-mile, $4.5 million pipeline about 3 miles south of Edgemont. One pipeline crew headed westward toward an existing pipeline southwest of Douglas, Wyo.; another crew proceeded northwest toward Rapid City. When completed the pipeline was to carry petroleum products from three Casper, Wyo., oil refineries to the terminal under construction at Rapid City. The pipeline and terminal were to be completed by the end of February 1963.

REVIEW BY COUNTIES

Mineral production was reported from all but 7 of the 67 counties in the State. Bennett, Edmunds, Hughes, Shannon, Stanley, Todd, and Tripp Counties had no mineral production. Forty counties had increases, 25 had decreases, and 2 had no changes in value of mineral production, compared with 1961 figures. The changes were due mostly to increases or decreases in value of sand and gravel output. Only those counties with larger values or with significant changes in mineral production are discussed below; see table 10 for additional details.

Butte.—Mineral production increased $76,700 or 12 percent in value over that of 1961. Clays, sand and gravel, lime, and stone were produced as in 1961; only clays decreased in production. The clay producers were American Colloid Co. (bentonite) and Black Hills Clay Products Co. (miscellaneous clay). At its plant at Belle Fourche, American Colloid Co. processed bentonite mined in South Dakota and Wyoming. At its Belle Fourche plant, IMC processed bentonite from Wyoming only.

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TABLE 10.—Value of mineral production in South Dakota, by counties[1]

County	1961	1962[2]	Minerals produced in 1962 in order of value
Aurora	$32,345	$32,100	Sand and gravel.
Beadle	76,380	81,290	Sand and gravel, stone.
Bon Homme	110,200	115,600	Sand and gravel.
Brookings	377,463	289,700	Do.
Brown	207,300	272,107	Sand and gravel, stone.
Brule	62,709	47,402	Sand and gravel, gem stones.
Buffalo	28,700	62,940	Sand and gravel, stone.
Butte	648,557	725,209	Clays, sand and gravel, lime, stone.
Campbell	31,700	170,347	Sand and gravel, stone.
Charles Mix	139,038	164,778	Sand and gravel, stone, gem stones.
Clark	77,877	196,831	Sand and gravel, stone.
Clay	38,800	31,500	Sand and gravel.
Codington	276,402	346,400	Do.
Corson	(3)	171,677	Sand and gravel, stone.
Custer	[4] 734,266	702,307	Uranium ore, feldspar, sand and gravel, lime, vanadium, beryllium concentrate, stone, mica (sheet), gem stones, lithium minerals.
Davison	176,298	98,900	Sand and gravel.
Day	71,861	129,900	Do.
Deuel	11,066	100,300	Do.
Dewey	95,047	101,510	Coal, sand and gravel.
Douglas	141,683	63,300	Sand and gravel.
Edmunds	76,776		
Fall River	[4] 365,924	282,286	Sand and gravel, uranium ore, stone, vanadium.
Faulk	103,000	184,019	Sand and gravel, stone.
Grant	2,865,574	2,437,093	Stone, sand and gravel.
Gregory	100,853	127,908	Sand and gravel, stone.
Haakon	71,100	126,300	Sand and gravel.
Hamlin	14,028	67,431	Sand and gravel, stone.
Hand	56,900	64,400	Sand and gravel.
Hanson	(3)	617,228	Stone, sand and gravel.
Harding	[4] 574,884	(3)	Petroleum, sand and gravel.
Hughes	256,793		
Hutchinson	73,291	80,207	Sand and gravel, stone.
Hyde	25,200	48,840	Do.
Jackson		68,966	Do.
Jerauld	65,580	14,000	Sand and gravel.
Jones	14,500	7,500	Do.
Kingsbury	74,876	292,237	Sand and gravel, stone.
Lake	117,800	114,200	Sand and gravel.
Lawrence	19,747,169	20,574,158	Gold, sand and gravel, silver, stone, lead, gem stones.
Lincoln	634,190	177,600	Sand and gravel.
Lyman	22,709	76,600	Do.
Marshall	39,562	277,700	Do.
McCook	84,715	1,250	Stone.
McPherson	32,400	73,547	Sand and gravel, stone.
Meade	165,665	455,455	Do.
Mellette	4,500	43,100	Sand and gravel.
Miner	41,100	159,079	Sand and gravel, stone.
Minnehaha	1,922,908	1,807,880	Stone, sand and gravel.
Moody	158,732	149,200	Sand and gravel.
Pennington	11,014,262	11,016,445	Cement, stone, sand and gravel, clays, iron ore, gypsum, beryllium concentrate, feldspar, mica (scrap), gem stones, lithium minerals, uranium ore, mica (sheet).
Perkins	35,964	174,821	Sand and gravel, stone, gem stones.
Potter		29,700	Sand and gravel.
Roberts	80,200	269,851	Sand and gravel, stone.
Sanborn	1,900	9,300	Sand and gravel.
Shannon	14,850		
Spink	79,015	258,186	Sand and gravel, stone.
Stanley	34,900		
Sully	47,600	12,600	Sand and gravel.
Tripp	86,509		
Turner	188,400	344,100	Sand and gravel.
Union	418,200	44,600	Do.
Walworth	69,300	116,500	Do.
Washabaugh		866	Stone.
Yankton	56,800	77,300	Sand and gravel.
Ziebach	30,401	75,500	Do.
Undistributed[5]	[4] 800,734	1,127,035	
Total	[4] 44,007,000	45,789,000	

[1] Bennett and Todd are not listed because no production was reported.
[2] Value of petroleum is preliminary.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Revised figure.
[5] Includes production of some sand and gravel and gem stones that cannot be assigned to specific counties and values indicated by footnote 3.

Value of sand and gravel production was $158,000 or twice that of 1961. Harold Dodd, Cole Building Supply Co., and J. B. Connors were commercial sand and gravel operators. The Butte County Highway Department produced sand and gravel for road repairs. Contractors for the State department of highways produced sand and gravel and crushed stone for road construction. Utah-Idaho Sugar Co. produced lime (quicklime) at its Belle Fourche sugar beet factory.

Custer.—The value of mineral production decreased $32,000, or 4 percent; increases in outputs of sand and gravel, gem stones, lithium minerals, and feldspar over those of 1961 almost offset the decreases in production of beryl, mica, stone, lime, petroleum, uranium ore, and vanadium. Sand and gravel output showed the greatest increase in value, from $45,400 in 1961 to $118,000 in 1962. The county was the State's leading source of beryl, gem stones, feldspar, mica, uranium ore, and vanadium.

Lithium ore was produced at the Tin Mountain mine operated by Clifford & Chord. Although only 44 operations were active, compared with 53 in 1961, feldspar production increased about 500 tons. The Shamrock mine of IMC was the leading source of feldspar. The Albino No. 1 (operated by Royce McRobbie), White Elephant (Briggs Manufacturing Co.), Tip Top (Fred Tubbs), St. Louis (Wineteer & Yanda), and Beck (Charles Stiles) were the only other mines which individually produced over 1,000 long tons of feldspar. Twelve operations each produced between 100 and 1,000 long tons of feldspar, and 26 operations each had an output of less than 100 tons. IMC operated its ground feldspar plant at Custer throughout the year. One-third of the State's total value of gem stones was attributed to the county; rose quartz, agate, jasper, and chalcedony were the gem materials collected.

Beryl output was one-half that of 1961 and mica was one-eighth, mainly the result of the termination of the Federal Government buying program for these two commodities in June. Beryl was obtained from only 20 operations compared with 55 in 1961. Beryl production, 76,343 pounds, averaging 11.12 percent beryllium oxide (BeO) was valued at $20,691. Walter S. Clifford and Arthur H. Lyndoe, each having an output of over 10,000 pounds, produced the most beryl. Twelve operations each produced between 1,000 and 10,000 pounds of beryl and 6 operations less than 1,000 pounds.

Six operations were the only sources of mica production, compared with 17 in 1961. Mica producers were Homestead Mining Co. with two operations and Tom Druyvestine, Lester Sander, Duncan & Shull, and Bernie Van Der Vorste each having one operation. Stone production consisted of limestone mined by Black Hills Lime Co.; quicklime was produced from the limestone. No petroleum output was reported because the only oil well, Helms No. 1 Coffing, did not produce. Oil well exploration was resumed; however, the four wells drilled were dry holes.

Although nine operations were active compared with four in 1961, uranium ore production was less than that of last year. Walter L. McKenna, Bettenhausen & Wheeler, Wayne Sundstrom, Black Hills Uranium Co., and Susquehanna-Western, Inc., produced uranium

ore. The drop in uranium ore production was the cause of the decrease in byproduct vanadium output.

Fall River.—The $84,000 or 23-percent decline in value of mineral production below that of 1961 resulted from decreases in output of gem stones, uranium ore, and vanadium. Output of sand and gravel and of stone were more than in 1961. Flyte Sand and Gravel Co., Oral Sand Co., and Fall River Gravel & Sand Co. were commercial sand and gravel operators. The South Dakota Department of Highways accounted for the balance of the sand and gravel production, mainly used on its road-construction projects. No gem stones were reported collected. Production of uranium ore decreased considerably below that of 1961 and adversely affected the output of byproduct vanadium. The 19 active uranium operations, 4 fewer than last year, were worked by Black Hills Uranium Co., Chord Uranium Co., Earl Boner, Walter L. McKenna, F. J. & F. Albright, Roy E. Chord, and Ray Fay. Three exploratory oil wells drilled were unsuccessful.

Grant.—The county was one of four that had mineral production valued at over $1 million. Because of the granite industry, the county was the leading State producer of stone in terms of value. However, the value of stone production decreased $386,000 or 14 percent below that of 1961. The decrease in value of production of sand and gravel, the only other mineral commodity, plus the decrease in stone, resulted in a $428,000 or 15-percent drop in value of mineral production for the county below that of 1961. Cold Springs Granite Co.; Dakota Granite Co.; Delano Granite Works, Inc.; North Star Granite Corp.; Robert Hunter Granite Co. Inc., and Steiner-Rausch Granite Co., Inc., quarried granite. As in past years, some of the rough granite blocks were shipped to Minnesota for finishing. Sand and gravel production dropped from 102,200 short tons in 1961 to 25,500 tons in 1962 because of a decrease in road construction. Walter Lindberg sold some sand and gravel from his pit. The remainder was produced by a contractor for the South Dakota Department of Highways.

Harding.—All the petroleum production in the State came from this county. The 19 oil wells active last year also pumped oil this year; production, however, was 61,500 barrels (27 percent) less than that of 1961. No oil well exploration drilling was reported during the year, whereas in previous years there had been some activity. The one exploratory well reported uncompleted last year was reported as unsuccessful. Shell Oil Co. sold its holdings in the county, including 13 active oil wells, to Zapata Petroleum Corp. about November 1.

Output of sand and gravel, which was 122,000 tons or 5 times more than in 1961, was used on road construction projects of the State department of highways.

After a lapse of a few years, mining of uranium-bearing lignite began in the fall, when Kermac Nuclear Fuels Corp. and Susquehanna-Western, Inc., announced their interest in acquiring this lignite for uranium recovery. Susquehanna-Western, Inc., set up a buying station at Buffalo in September and purchased uranium-bearing lignite produced by operators in the Cave Hills and Slim Buttes areas; this lignite was stockpiled at the buying station. Kermac Nuclear Fuels Corp. mined and stockpiled uranium-bearing lignite from its properties near Riley Pass in the Cave Hills area.

Lawrence.—The county retained its leading position in value of mineral production and established a new record for a South Dakota county total, surpassing its previous high of 1958 by $96,664. All commodities produced in the county, except gem stones, showed increases in value of production. Gold output accounted for 98 percent of the total value of mineral production.

Virtually all the gold and silver produced was mined by Homestake Mining Co. Homestake operated its mine and amalgamation-cyanidation mill at Lead the entire year. According to the company's annual report to stockholders, metallurgical recovery was 97.39 percent compared with 97.28 percent in 1961. Total direct operating costs increased 29 cents per ton, but general costs were 10 cents per ton less. Facilities for mining below the 4,850-foot level were completed in April, and the ore-haulage system on this level was placed in operation in September. Eight hundred tons per day was to be mined from stopes below this level beginning in early 1963. Sinking of the No. 4 winze from the 6,200- to the 6,800-foot level began in July and had reached 6,547 feet below the surface at yearend. Extension of the winze would make available for development another 600 feet of the principal ore zones and permit further testing of structures to the west, where indications of ore continued to be encouraging.

TABLE 11.—Homestake mine ore milled, receipts, and dividends [1]

Year	Ore milled (thousand short tons)	Receipts for bullion product		Dividends (thousands)
		Total (thousands)	Per ton	
1958	1,725	$19,611	$11.37	$4,019
1959	1,746	20,120	11.52	4,019
1960	1,767	19,465	11.02	4,021
1961	1,781	19,590	11.00	4,030
1962	1,869	20,271	10.85	3,242

[1] From 1876 to 1962, inclusive, this mine yielded bullion and concentrates that brought a net return of $737.9 million and paid $218.1 million in dividends.

Source: Homestake Mining Co. annual report to stockholders.

All the lead produced in the State and the balance of gold and silver came from Hage Bros., Inc., Silver Queen mine located southeast of Lead. Sand and gravel, which rose in output from 37,100 tons in 1961 to 248,000 tons, was produced by the Lawrence County Highway Department for road maintenance and by contractors of the State department of highways for road construction. Crushed limestone was produced for road construction and for making lime. Crushed granite was produced by a contractor for the City of Lead for aggregate in making bituminous pavement. Jasper was the only gem material reported collected.

Minnehaha.—The county was among the four in the State which had mineral production worth over $1 million. The total value was about $100,000 (5 percent) below that of 1961, because output of the two commodities (stone and sand and gravel) produced in the county dropped slightly below that of 1961. Two-thirds of the value was derived from stone production and one-third from sand and gravel

production. Only one other county, Pennington, had greater output of sand and gravel and of stone. Three operators—Concrete Materials Co., L. G. Everist, Inc., and Hector Construction Co.—accounted for the stone production. Commercial sand and gravel producers were Concrete Materials Co., Steve R. Oberg Construction Co., and Eagle Sand and Gravel Co. Contractors produced sand and gravel for road-construction projects of the Federal Bureau of Public Roads and the State department of highways.

Pennington.—Only one county, Lawrence, had a larger value of mineral production than Pennington. Irrespective of individual changes in values of output for commodities produced, the total value was almost exactly the same as that of last year. The 12 commodities produced gave the county the distinction of having the most diversified mineral production. The county was the leading sand and gravel producer and the only one in the State having a stone output of over 1 million tons. The stone output in Grant County, however, had a higher value per ton, and Grant surpassed Pennington in value of stone production. The entire State production of cement, gypsum, and iron ore was from this county.

The one-third drop in beryl production was caused by the termination in June of the Federal Government domestic beryl purchasing program. Only 9 operations produced beryl compared with 27 last year. The Hugo Lode mine operated by Hough & Judson was the largest beryl producer in the State and the only one to exceed the 100,000-pound mark for beryl production. Two operators each had production between 10,000 and 100,000 pounds of beryl, three between 1,000 and 10,000 pounds, and three less than 1,000 pounds. Mica production was adversely affected by the termination in June of the Federal Government domestic mica buying program. Mica production came from two mines: Hough & Judson produced scrap mica from the Hugo mine, and Northwest Beryllium Co. produced sheet and scrap mica from the Peerless mine, which the company acquired early in 1962 from Peerless Minerals, Inc. Although seven operations were active, compared with six in 1961, output of feldspar was 197 long tons (13 percent) below that of the last year. None of the operations yielded over 1,000 tons. Robert Stilen with three operations and Elfred Hazeltine, Hough & Judson, Keystone Chemical Co., and Carl Salmen with one operation each produced feldspar. Production of lithium minerals was reported; however, the ore sold by IMC had been mined by Hough & Judson from the Hugo Lode in 1961.

The South Dakota Cement Commission produced limestone, gypsum, clay, and sand and gravel for its cement plant at Rapid City. The cement plant was operated throughout the year, but production was curtailed at times because of a railroad strike. Lightweight Aggregates, Inc., was the only other clay producer in the county. Pete Lien & Sons produced the total output of iron ore from the Dungey Bog and Painter pits near Rochford. Five commercial and three noncommercial producers reported sand and gravel production. About 98 percent of the 1.4 million tons of sand and gravel reported as production in the county was used for road construction. Black Hills Silica Sand Corp. produced some silica sand from its operation west of Hill

City; most of the output was used in the oil hydrafracing process of recovering oil and gas. Stone production increased 161,000 tons or 12 percent above that of 1961. Seven operators accounted for the total output of stone, which was mostly crushed limestone. One operator produced some dimension limestone.

Uranium ore production (shipments) was again attributed to the county after a lapse of 5 years as Walter Wilk produced a small quantity of ore from the Rube No. 1 mine. One exploratory oil well drilled in the fall was a dry hole; the last previous well was drilled in 1957.

The Mineral Industry of Tennessee

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Tennessee Division of Geology for collecting information on all minerals except fuels.

By James R. Boyle,[1] William D. Hardeman,[2] and Mildred E. Rivers [3]

RECORD production of portland and masonry cements, ball clay, phosphate rock, crushed limestone, crushed sandstone, copper, and silver highlighted the mineral industry of Tennessee in 1962. Tennessee led the Nation in production of ball clay, pyrite, and zinc, ranked second in output of phosphate rock and dimension marble and fourth in production of fuller's earth and dimension sandstone. The total value of mineral production was 2 percent more than in 1961, the previous record year.

Leading industries were copper and zinc mining, stone quarrying, cement manufacturing, coal mining, phosphate rock mining and processing, and sand and gravel mining, which together furnished 92 percent of the total value of production. Leading companies were Tennessee Copper Co. (gold, silver, copper, lead, pyrite, and zinc), American Zinc Co. of Tennessee (zinc and limestone), Tennessee Coal & Iron (zinc and limestone), Ideal Cement Co. (cement, limestone, and clay), Penn-Dixie Cement Corp. (cement, limestone, and clay), Marquette Cement Manufacturing Co. (cement, limestone, and clay), Monsanto Chemical Co. (phosphate rock), and Lambert Bros. (crushed limestone).

Employment and Injuries.—Reports received by the Bureau of Mines indicate that employment increased 3 percent. The increase was distributed among all industries except coal and sand and gravel mines. Employment at metal mines increased 18 percent, due mainly to the new mine of New Market Zinc Co. The number of men working at coal mines declined by 493, and employment declined 10 percent.

Injury experience was considerably better. The frequency rate decreased from 24 to 15. Individual injury reports from quarry operators showed, for the first time, an actual frequency rate of 12. There were 11 fatalities compared with 9 in 1961 and 14 in 1960.

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TABLE 1.—Mineral production in Tennessee[1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite—short tons	(2)	(2)	13,797	$229
Cement:				
Masonry—thousand 280-pound barrels	1,018	$2,753	1,089	2,931
Portland—thousand 376-pound barrels	8,357	26,964	8,509	27,741
Clays[3]—thousand short tons	1,040	4,190	1,037	4,597
Coal (bituminous)—do	5,860	20,681	6,214	22,555
Copper (recoverable contents of ores, etc.)—short tons	12,272	7,363	14,298	8,808
Gem stones	(4)	1	(4)	1
Gold (recoverable content of ores, etc.)—troy ounces	152	5	158	6
Lead (recoverable content of ores, etc.)—short tons			51	9
Natural gas—million cubic feet	71	13	75	14
Petroleum (crude)—thousand 42-gallon barrels	17	(2)	[5] 18	(2)
Phosphate rock—thousand long tons	2,235	18,675	2,418	19,868
Sand and gravel—thousand short tons	6,232	8,046	6,075	8,018
Silver (recoverable content of ores, etc.)—troy ounces	83,417	77	112,251	122
Stone—thousand short tons	23,940	35,906	24,398	35,614
Zinc (recoverable content of ores, etc.)—short tons	81,734	18,799	71,548	16,456
Value of items that cannot be disclosed: Fuller's earth, iron ore, lime, pyrite, and values indicated by footnote 2		[6] 7,238		7,061
Total		[6] 150,711		154,030

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Excludes fuller's earth; included with "Value of items that cannot be disclosed."
[4] Weight not recorded.
[5] Preliminary figure.
[6] Revised figure.

Trends and Developments.—New Market Zinc Co., a joint venture of American Zinc Co. of Tennessee and Tri-State Zinc Co., has sunk a circular shaft over 1,000 feet; the planned depth is 2,100 feet. It has completed construction of the mill, headframe and surface buildings. Cowin & Co. Inc., mining engineers and contractors, Birmingham, Ala., was sinking the shaft. The site of the mill and shaft is 2 miles southeast of New Market.

Tennessee Valley Authority's (TVA) Melton Hill Dam in Loudon County will be completed early in 1963. The dam is 1,072 feet long and 80 feet high and will add 72,000 kilowatts to the TVA system. The TVA Bull Run steam electric plant is being built on the shore of the Melton Hill reservoir in Anderson County. The first turbogenerator to be installed will have a capacity of 900,000 kilowatts, and plans provide for adding one to three more turbogenerators of the same or larger capacity. TVA is also cooperating with the Atomic Energy Commission in the erection of an experimental gas-cooled reactor with a capacity of 22,000 kilowatts at the Oak Ridge Laboratories in Anderson County.

Consolidated Aluminum started construction of a $20-million aluminum ingot smelter in Humphreys County. This plant will have an initial capacity of 20,000 tons per year.

TVA announced the establishment of a Mineral Resources Section in its Geologic Branch. It will develop information on mineral resources of the Tennessee Valley region.

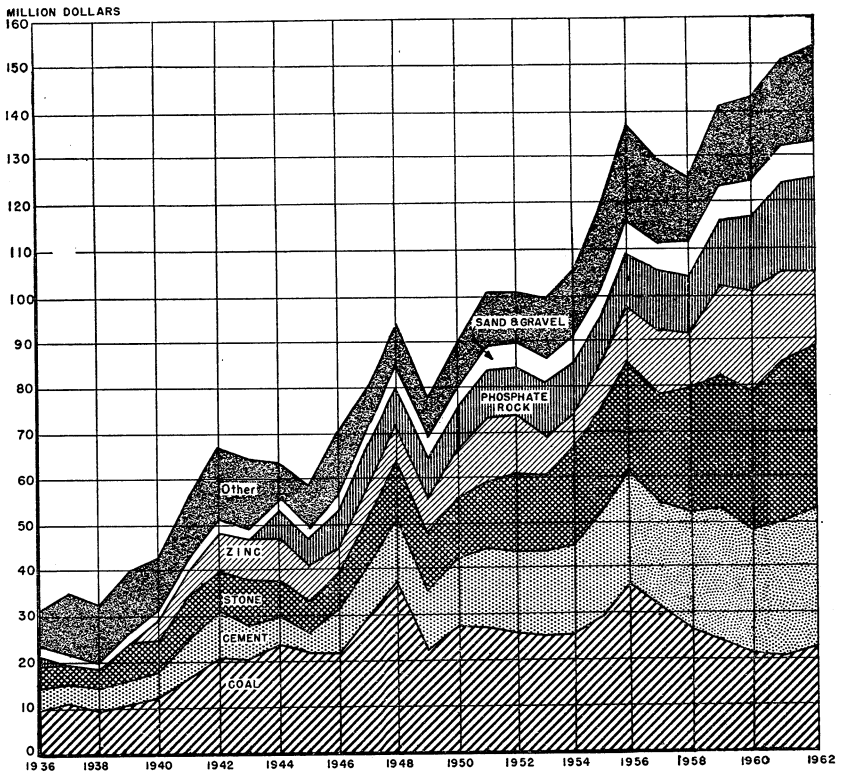

FIGURE 1.—Value of mineral production in Tennessee, 1936–62.

TABLE 2.—Employment and injuries in the mineral industries

Year and industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:							
Quarries and mills	151	3,305	250	6,888,347	1	200	29
Coal mines	555	3,967	146	4,579,955	6	175	40
Metal mines and mills	17	1,305	248	2,593,945	----------	39	15
Coke ovens and smelters	4	974	354	2,762,345	----------	9	3
Nonmetal mines and mills	32	1,104	211	1,898,683	2	36	20
Sand and gravel mines	37	586	258	1,261,664	----------	29	23
Total	796	11,241	219	19,984,939	9	488	24
1962:[1]							
Quarries and mills	152	3,373	265	7,136,840	3	86	12
Coal mines	454	3,474	149	4,128,400	5	94	24
Metal mines and mills	16	1,444	264	3,052,928	----------	48	16
Coke ovens and smelters	4	996	362	2,882,992	----------	9	3
Nonmetal mines and mills	35	1,295	207	2,197,481	1	25	12
Sand and gravel mines	42	571	231	1,153,996	2	29	27
Total	703	11,153	229	20,552,637	11	291	15

[1] Preliminary figures.

Sheffield Southern Steel Products Co. began operations at Knoxville in the processing and distribution of flat rolled carbon steel products.

Aluminum Company of America's facility at Alcoa started production of new stainless clad aluminum sheets for use in the manufacture of cooking utensils and small appliances.

E. I. du Pont de Nemours & Co., Inc. initiated an expansion program which will increase its production of titanium dioxide at its New Johnsonville plant by 20 percent. Completion of this program is expected to be early in 1963.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Three operators mined crude barite from four mines in two counties for oil-well-drilling muds, chemicals, and other uses. The leading producer was J. M. Godsey (Athens mine). Production increased 48 percent but was still 87 percent below that in 1941, the record year.

Cement.—Four companies produced masonry cement at five plants in five counties; the leading producer was Marquette Cement Manufacturing Co. Shipments increased 7 percent above those in 1961 and 2 percent above those in the previous record year of 1955. Consumption in Tennessee was 56 percent, and shipments were made to North Carolina (19 percent), Georgia (9 percent), South Carolina (6 percent), Kentucky (3 percent), Alabama (3 percent), Virginia (3 percent), and other States (1 percent).

Four companies produced portland cement at six plants in six counties. The leading producer was Ideal Cement Co. Shipments increased 2 percent above those in 1961 and also 2 percent above those in the previous record year of 1959. Raw materials used in cement included cement rock and limestone (86 percent), clay and shale (8 percent), gypsum (3 percent), and other (3 percent). Consumption in Tennessee was 47 percent, and shipments were made to North Carolina (25 percent), Georgia (16 percent), Virginia (3 percent), South Carolina (3 percent), Alabama (3 percent), Kentucky (2 percent), and other States (1 percent).

Portland cement was used as follows: In ready-mixed concrete (59 percent), in concrete products (18 percent), by highway contractors (12 percent), by building-materials dealers (7 percent), and in other ways (4 percent).

Tri-State Concrete Products Co. Inc. has constructed a concrete block plant at Kingsport at a cost of $600,000. The plant will also be capable of producing prestressed, precast, and lightweight concrete products.

Construction was started on a new $250,000 plant of Cen-Vi-Ro Pipe, Inc., at Tullahoma. This plant will manufacture a new type of concrete pipe under a patented process.

Clays.—Tennessee led the Nation in producing ball clay. Five companies operated six mines in Henry and Weakley Counties; leading producers were H. C. Spinks Clay Co. Inc. and United Clay Mines

Corp. Production increased 7 percent above that of 1961 and 2 percent above that of the previous record year of 1959.

TABLE 3.—Ball clay sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Whiteware, etc.	181,803	$2,493,587	$13.72	187,088	$2,543,442	$13.59
Floor and wall tile	47,376	654,304	13.81	50,900	733,334	14.41
Other [1]	60,541	761,878	12.58	71,517	883,074	12.35
Total	289,720	3,909,769	13.49	309,505	4,159,850	13.44

[1] Includes foundries and steelworks, heavy clay products, saggers, pins, stilts, wads, firebrick and block, enameling, exports, and other uses.

Southern Clay Co. Inc. and Tennessee Absorbent Clay Co. mined fuller's earth in Henry County for absorbent use. Production increased slightly. Tennessee ranked fourth in the Nation in the production of fuller's earth.

Ten companies mined miscellaneous clay at 12 mines in 9 counties for building brick, heavy clay products, lightweight aggregate, and cement. Leading counties were Knox, Sullivan, and Davidson; leading producers were General Shale Products Corp. and W. G. Bush & Co. Inc. Production decreased 3 percent, and was 30 percent below the record in 1956.

Feldspar.—The Feldspar Corp. plant at Erwin ground crude feldspar from North Carolina for glass, pottery, and enamel.

Gem Stones.—Collection of gem stones was reported from three counties. Bedford was the leading county, and agate was the predominant gem stone.

Lime.—Standard Lime & Cement Co., Knoxville, Williams Lime Mfg. Co., Knoxville, and Victor Chemical Works, Nashville, produced quicklime and hydrated lime for building, chemical, and industrial uses. Production decreased 4 percent. Consumption in Tennessee was 43 percent, and shipments were made to North Carolina (35 percent), Kentucky (9 percent), Ohio (5 percent), South Carolina (4 percent), and other States (4 percent).

Mica.—Carolina-Southern Mining Co., Inc., at Erwin produced ground mica for welding rods and joint cement from scrap shipped from North Carolina.

Perlite.—Tennessee Products & Chemical Corp. expanded crude perlite from Colorado at the Nashville plant.

Phosphate Rock.—Nine companies mined and processed phosphate rock in Davidson, Giles, Hickman, Maury, and Williamson Counties. Leading producers were Monsanto Chemical Co. and Hooker Chemical Co. Marketable production increased 8 percent over that in 1961, the previous record year. Tennessee ranked second in the Nation in the production of phosphate rock.

Victor Chemical Corp. will construct a new slag crushing facility at its Mt. Pleasant furnace plant. The new facility will be in-

stalled to remove and process slag from furnace plant operations into materials for use as concrete aggregate and railroad ballast and in mineral wool manufacture and road construction. The slag plant will be capable of producing 250 tons per hour of various sizes and blends. Virginia-Carolina Chemical Corp. planned to construct a phosphorus furnace and modernize existing nodulizing and rock washing facilities at Mt. Pleasant. The furnace will be capable of handling 20,000 tons of phosphorus per year.

TABLE 4.—Phosphate rock sold or used by producers, by uses

Use	1961			1962		
	Long tons	Value		Long tons	Value	
		Total	Average per ton		Total	Average per ton
Elemental phosphorus	2,134,830	$17,629,436	$8.26	2,366,022	$19,079,090	$8.06
Ordinary superphosphate [1]	72,563	692,283	9.54	55,538	543,733	9.79
Direct application to the soil	74,571	699,601	9.38	54,523	549,757	10.08
Other	9,234	77,577	8.40			
Total	2,291,198	19,098,897	8.34	2,476,083	20,172,580	8.15

[1] Includes rock for phosphoric acid (wet process) (1961), fertilizer filler (1962), and pig-iron blast furnace (1962).

Pyrite.—Tennessee Copper Co. recovered pyrite concentrate from sulfide ore mined in Polk County. Production remained about the same as in 1961 and was 2 percent below the record year of 1957. Tennessee continued to lead the Nation in output of pyrite.

Sand and Gravel.—Thirty-seven commercial operators mined sand and gravel at 43 locations in 24 counties. Government-and-contractor production amounted to 7 percent of the total mined. There were four Government-and-contractor operators at four locations in four counties. Leading producing counties were Shelby, Benton, and Davidson. Leading commercial producers were Cordova Sand & Gravel Co. Inc., Hardy Sand Co., and Sangravel Co. Inc. Production decreased 2 percent and was 3 percent below the record in 1960. Of the total production, 91 percent was washed. Transportation was as follows: 78 percent was hauled by truck, 20 percent by rail, and 2 percent by water.

American-Saint Gobain Corp. dedicated a $55-million plate glass plant at Greenland. This plant is one of three in the United States for modern continuous twin grinding.

Chattanooga Glass Co. opened its new $1-million all-electric furnace at its plant in Chattanooga.

Ford Motor Co. completed construction of an "in line tempering lehr" at its Nashville glass plant.

Stone.—Fifty-one commercial operators crushed limestone at 72 quarries in 50 counties. Government-and-contractor production amounted to 6 percent of the total crushed limestone and was produced at 28 quarries in 21 counties. Leading producing counties were Knox, Davidson, and Hamilton. Leading commercial producers were Lambert Bros. (Blount, Claiborne, Davidson, Hawkins, Hum-

TABLE 5.—Sand and gravel sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Benton	657,161	$1,094,997	716,644	$1,222,594
Carter	15,000	15,000		
Cumberland	(1)	(1)	63,000	95,850
Fayette	144,669	125,340		
Giles	175,000	140,000		
Grundy			72,000	120,000
Haywood	31,767	25,414	67,670	54,000
Lauderdale	97,063	77,650	65,324	54,872
Loudon	25,676	33,722	(1)	(1)
Maury	40,000	80,000		
Monroe	14,217	21,325	30,046	44,350
Obion	117,420	93,936	122,994	45,553
Sevier	48,600	57,952	27,700	30,100
Shelby	1,297,067	1,097,834	1,622,779	1,405,257
Tipton	298,270	294,116	304,279	264,066
Unicoi	329,863	491,113	(1)	(1)
Warren	58,000	87,000		
Undistributed [2]	2,882,541	4,310,799	2,982,749	4,681,128
Total	6,232,314	8,046,198	6,075,185	8,017,777

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes Bradley (1962), Carroll, Davidson, Decatur, Franklin, Greene, Hamilton, Hardeman, Henderson, Humphreys, Knox, McNairy, Putnam, Stewart, and Wayne Counties and counties indicated by footnote 1.

TABLE 6.—Sand and gravel sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	1,748,123	$2,605,059	$1.49	1,953,767	$3,052,283	$1.56
Paving	562,279	664,480	1.18	719,830	817,737	1.14
Molding	208,727	608,823	2.92	225,147	678,046	3.01
Engine	1,037	1,555	1.50	1,508	2,262	1.50
Other sand	355,966	734,692	2.06	(1)	(1)	(1)
Total	2,876,132	4,614,609	1.60	(1)	(1)	(1)
Gravel:						
Paving	1,981,599	1,651,418	.83	1,432,381	1,118,307	.78
Structural	1,258,570	1,625,844	1.29	1,031,833	1,282,457	1.24
Other gravel	116,013	154,327	1.33	(1)	(1)	(1)
Total	3,356,182	3,431,589	1.02	(1)	(1)	(1)
Total sand and gravel	6,232,314	8,046,198	1.29	6,075,185	8,017,770	1.32

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Total sand and gravel."

phreys, Knox, Roane, Sevier, Sullivan, and Williamson Counties), and Chattanooga Rock Products (Hamilton and Marion Counties). Production increased 2 percent above that of the previous record year 1961. Of the total commercial production, 92 percent was hauled by truck, 6 percent by rail, and 2 percent by waterway.

John J. Craig Co., Appalachian Marble Co., and Knoxville Crushed Stone Co. crushed marble for terrazzo and other uses. Production increased 29 percent but was 36 percent below the record in 1948.

John J. Craig Co. (Hamil, Marmor, Crisp, and Lee quarries), Tennessee Marble Co. (French Pink, Brown, and Gray Knox quarries), Appalachian Marble Co. (Bond and Appalachian quarries), and Imperial Black Marble Corp. (Thornhill quarry) quarried dimension marble in Blount, Grainger, Knox, and Union Counties. Production decreased 13 percent and was 30 percent below the record in 1957. Tennessee ranked second in production of dimension marble. White Silica Sand Co., Sewanee Silica Co., Tipton Construction Co. Inc., and Turner Bros. Stone Co. Inc. crushed sandstone. Production increased 2 percent over that in 1961, the previous record year. Ten companies quarried dimension sandstone at 10 quarries in Cumberland, Fentress, and Morgan Counties for rough architectural, sawed and dressed building stone, and flagging. Leading producers were Crab Orchard Stone Co. Inc. and Tennessee Stone Co. Inc. Production decreased 6 percent and was 50 percent below the record in 1955. Tennessee ranked fourth in production of dimension sandstone.

TABLE 7.—Crushed limestone sold or used by producers, by counties

County	1961		1962	
	Short tons	Value	Short tons	Value
Blount	343,752	$509,019	(1)	(1)
Claiborne	77,979	103,654	(1)	(1)
Clay	40,000	60,000	(1)	(1)
Cocke	37,500	45,000	41,450	$50,000
Cumberland	(1)	(1)	390,146	511,757
Davidson	2,159,014	2,368,629	2,576,156	2,964,789
Decatur	494,870	611,210	(1)	(1)
De Kalb	60,500	60,500	31,879	31,879
Fayette	68,186	85,914		
Fentress	151,900	204,600	134,400	177,000
Franklin	717,071	879,411	859,301	1,113,035
Giles	240,000	336,000	200,000	250,000
Grainger	41,847	52,450		
Grundy	45,777	50,772	83,100	105,975
Hamblen	402,000	491,182	(1)	(1)
Hancock	60,000	75,600		
Hawkins	100,683	133,282	(1)	(1)
Humphreys	577,210	792,719	(1)	(1)
Knox	3,321,704	4,922,474	2,688,024	4,490,048
Lawrence	20,793	29,059	(1)	(1)
Lincoln	96,270	120,338	(1)	(1)
Macon	142,309	192,116	85,000	115,000
Marion	865,335	1,116,402	936,010	1,196,321
Montgomery	(1)	(1)	477,745	595,957
Pickett			35,968	44,959
Putnam	(1)	(1)	420,000	537,500
Sevier	131,844	185,373	(1)	(1)
Sumner	368,969	419,002	336,539	439,238
Unicoi	5,760	7,258		
Union	30,000	37,500	8,750	10,850
Washington	378,000	440,730	202,711	243,153
White	269,005	321,020	322,800	328,920
Williamson	457,498	604,361	(1)	(1)
Wilson	780,890	735,208	(1)	(1)
Undistributed [2]	11,095,563	14,513,952	14,244,101	18,024,353
Total	23,582,229	30,504,735	24,074,080	31,230,734

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes Anderson, Bedford, Bradley, Campbell, Cannon, Carter, Coffee, Green, Hamilton, Hardin (1962), Jefferson, Johnson, Loudon (1961), Marshall, Maury, McMinn, Meigs, Monroe, Overton, Rhea, Roane, Robertson, Rutherford, Sequatchie, Smith (1961), Sullivan, Warren, and Wayne counties, and counties indicated by footnote 1.

TABLE 8.—Crushed limestone sold or used by producers, by uses

Use	1961			1962		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roads	19,032,061	$23,687,729	$1.24	19,309,884	$24,103,718	$1.25
Cement and lime	2,219,231	3,382,470	1.52	2,284,061	3,705,760	1.62
Agstone	1,390,923	1,949,195	1.40	1,682,647	2,140,359	1.27
Stone sand	224,753	326,471	1.45	221,704	314,588	1.42
Railroad ballast	345,778	409,972	1.19	(1)	(1)	(1)
Mineral food	(1)	(1)	(1)	82,000	143,500	1.75
Riprap	(1)	(1)	(1)	41,674	50,364	1.21
Fluxing stone	(1)	(1)	(1)	27,000	37,800	1.40
Rock dust for coal mines	(1)	(1)	(1)	7,700	15,400	2.00
Other uses [2]	369,483	748,898	2.03	417,410	719,245	1.72
Total	23,582,229	30,504,735	1.29	24,074,080	31,230,734	1.30

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[2] Includes glass, asphalt filler, paper, fertilizer filler, filter beds (1961), other uses, and uses indicated by footnote 1.

TABLE 9.—Dimension marble sold or used by producers, by uses

Use	1961			1962		
	Quantity cubic feet	Value		Quantity cubic feet	Value	
		Total	Average per cubic foot		Total	Average per cubic foot
Building stone:						
Rough	(1)	(1)	(1)	187,345	$655,169	$3.50
Sawed, dressed	(1)	(1)	(1)	167,881	479,565	2.86
Cut, dressed	(1)	(1)	(1)	[2] 84,595	[2] 1,211,997	[2] 14.33
Monumental stone	(1)	(1)	(1)	(3)	(3)	(3)
Total	512,596	$3,303,948	$6.45	439,821	2,346,731	5.34

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Total."
[2] Includes a small quantity of monumental stone.
[3] Included with cut, dressed building stone.

The Division of Geology, Department of Conservation and Commerce, State of Tennessee, has published a bulletin (No. 65) entitled "Limestone and Dolomite Resources of Tennessee" by Robert E. Hershey and Stuart W. Maher.

MINERAL FUELS

Coal (Bituminous).—Bituminous coal was mined at 353 mines in 17 counties compared with 391 mines in 16 counties in 1961. Leading producing counties were Anderson, Campbell, and Marion. Leading producers were Pocahontas Fuel Co. (Morco mine), Rich Gap Coal Corp. (Rich Gap Strip mine), and Wind Rock Mining Co. (Windrock No. 2 mine). Production was 6 percent more than in 1961 but 30 percent below the record in 1956. Average production per mine increased from 15,000 to 17,600 tons.

TVA purchased mining rights on 52,942 acres of land in Campbell and Scott Counties from Koppers Co. Inc. for $625,000. The coal

reserve is for the Bull Run steam plant which is now under construction and scheduled to go into operation in 1965.

In the northern part of the State (District 8), 222 mines in 10 counties produced 4,800,184 tons of coal compared with 246 mines in 9 counties that produced 4,296,000 tons in 1961. Average production per mine increased from 17,500 to 21,600 tons. Underground mines produced 57 percent of the total; strip mines, 38 percent; and auger mines, 5 percent. Shipments were 69 percent by rail or water and 31 percent by truck. Captive tonnage was 1 percent of the total.

Equipment used at 168 underground mines included 96 cutting machines that cut 79 percent of the total tonnage, 135 power drills that drilled 81 percent, 69 locomotives, 40 shuttle cars, 4 mother conveyors, 22 mobile loading machines that loaded 56 percent, 4 continuous mining machines that loaded 10 percent, and 31 face conveyors that loaded 6 percent. Equipment used at 44 strip mines included 57 power shovels, 3 draglines, 40 bulldozers, 22 power drills, and 114 trucks. Equipment used at 10 auger mines included 9 coal-recovery augers, 7 bulldozers, and 8 trucks. Twenty-four percent of the coal was crushed, and 2 percent was cleaned.

In the southern part of the State (District 13), 131 mines in 7 counties produced 1,413,427 tons, compared with 145 mines in 7 counties that produced 1,564,000 tons in 1961. Average production per mine remained the same as in 1961, 10,800 tons. Underground mines produced 69 percent of the total, and strip mines, 31 percent. Shipments were 80 percent by rail or water and 20 percent by truck. The coal was sold in the open market, mainly to TVA.

Equipment used in 121 underground mines included 69 cutting machines that cut 55 percent of the total tonnage, 98 power drills that drilled 58 percent, 27 locomotives, 16 shuttle cars, 8 mother conveyors, 9 mobile loading machines that loaded 21 percent, and 12 self-loading conveyors that loaded 2 percent. Equipment used at 10 strip mines included 17 power shovels, 5 draglines, 13 bulldozers, 8 power drills, and 28 trucks. Of the total tonnage, 16 percent was crushed. The only cleaning plant was operated by Kopper-Glo Fuel, Inc., at Clairfield.

Coke.—Tennessee Products & Chemical Corp. produced metallurgical coke in byproduct coke ovens at Chattanooga. Chemcoke, Inc., produced chemical coke at Columbia.

Natural Gas.—Marketable production of natural gas increased 6 percent. At the end of the year 30 gas wells were producing. Cumulative production of natural gas since 1916 was 3,429 million cubic feet.

Petroleum.—Production of crude petroleum was 6 percent more than 1961. At the end of the year 40 oil wells were producing. Cumulative production since 1916 was 650,000 barrels. According to Oil & Gas Journal, exploratory drilling continued in Tennessee; completions were reported from 16 counties. Forty-three holes were completed, with a total footage drilled of 48,809. Gas was hit in three holes and crude in two. The gas was found in Pickett and Overton Counties and the crude in Clay and Putnam Counties. This compares with 73 completions in 1961, of which gas was found in 8, and crude in 5, with a total footage drilled of 55,121.

TABLE 10.—Coal (bituminous) production, by counties

County	1961		1962	
	Short tons	Value (thousands)	Short tons	Value (thousands)
Anderson	1,447,461	$5,724,433	1,589,141	$5,950,113
Bledsoe	26,606	89,459	20,894	72,419
Campbell	1,086,875	3,619,701	1,336,977	4,606,208
Claiborne	319,629	1,020,150	380,737	1,288,664
Cumberland	27,548	83,530	34,564	138,256
Fentress	75,132	226,446	92,024	276,072
Grundy	184,998	775,592	192,162	796,100
Hamilton	27,180	92,254	31,778	108,395
Marion	680,422	2,206,066	642,831	2,811,642
Morgan	326,496	995,345	317,991	1,104,059
Overton	81,662	227,836	74,942	208,338
Pickett			4,000	16,000
Putnam	463,520	1,866,454	485,318	1,867,729
Rhea	55,793	177,979	27,656	93,753
Scott	467,665	1,408,101	484,490	1,485,370
Sequatchie	438,515	1,638,747	288,793	938,577
Van Buren	150,186	528,868	209,313	793,488
Total	5,859,688	20,680,961	6,213,611	22,555,183
Earliest record to date	400,288,000	(1)	406,502,000	(1)

[1] Data not available.

METALS

Copper.—Tennessee Copper Co. recovered copper concentrate from sulfide ore mined in Polk County. Production of recoverable copper increased 17 percent over that of 1961 and 12 percent over that of 1960, the previous record. The company obtained satisfactory results using ANFO as an explosive in its underground operations and it doubled its facilities for the production of liquid sulfur dioxide.

Ferroalloys.—Shipments of ferromanganese, silicomanganese, ferrosilicon, ferrochromium, ferrochromic silicon, and ferrophosphorus totaled 111,397 tons valued at $17,951,952, a decrease of 3 percent in tonnage and value from 1961.

Gold.—Tennessee Copper Co. recovered gold as a byproduct from smelting copper and zinc concentrates. Production increased 4 percent but was 77 percent below the record set in 1930.

Iron Ore.—Big Flag Springs Mining Co. mined brown iron ore in Blount County, and Rockwood Mining Corp. mined red iron ore in Union County. Production of iron ore decreased 40 percent and was 99 percent below the record set in 1902.

Pig Iron.—Tennessee Products & Chemical Corp. produced foundry, basic, low-phosphorus, malleable, and chrome-bearing pig iron at Rockwood and Wrigley. Shipments declined 6 percent. Iron ore imported from Brazil comprised 4 percent of the iron ore consumed.

Lead.—Tennessee Copper Co. recovered lead as a byproduct from smelting copper and zinc concentrates. Production was 98 percent below the record set in 1917.

Silver.—Tennessee Copper Co. recovered silver as a byproduct from smelting copper and zinc concentrates. Production increased 35 percent over 1961 and 1 percent over the previous record year of 1920.

Zinc.—Tennessee continued to lead in zinc production, although output declined 12 percent from 1961 and 22 percent below the record year of 1960.

TABLE 11.—Mine production of recoverable gold, silver, copper, lead, and zinc

Year	Gold		Silver		Copper	
	Troy ounces	Value (thousands)	Troy ounces	Value (thousands)	Short tons	Value (thousands)
1953–57 (average)	219	$8	63,120	$57	9,413	$6,405
1958	124	4	44,592	41	9,109	4,791
1959	99	3	59,739	54	11,490	7,055
1960	123	4	64,560	58	12,723	8,168
1961	152	5	83,417	77	12,272	7,363
1962	158	6	112,251	122	14,298	8,808
831–1962	24,182	589	3,970,683	2,977	533,378	194,475

Year	Lead		Zinc		Total
	Short tons	Value (thousands)	Short tons	Value (thousands)	Value (thousands)
1953–57 (average)	2	$1	42,619	$10,274	$16,745
1958	----------	----------	59,130	12,063	16,899
1959	----------	----------	89,932	20,684	27,796
1960	----------	----------	91,394	23,580	31,810
1961	----------	----------	81,734	18,799	26,244
1962	51	9	71,548	16,456	25,401
1831–1962	27,143	3,185	1,597,014	322,381	523,607

American Zinc Co. of Tennessee operated the Young, Coy, and Grasselli mines in Jefferson County and the Mascot No. 2 mine in Knox County. New Jersey Zinc operated the Jefferson City mine in Jefferson County. Tennessee Coal & Iron operated the Zinc Mine Works in Jefferson County. Tennessee Copper Co. recovered zinc concentrate from copper-zinc ores mined in Polk County. Total crude ore milled was 3,498,000 tons. New Market Zinc Co., a joint venture of American Zinc Co. of Tennessee and Tri-State Zinc, Inc., was sinking a circular shaft 2,100 feet deep at New Market. The 2,800–3,500 tons per day concentrator is treating ores from American Zinc Co.'s Young mine until completion of the shaft and underground development. New Jersey Zinc's Jefferson City mine which was flooded most of the year returned to production in September. Its Flat Gap mine remained closed during 1962. American Zinc reopened the Coy and Grasselli mines in July.

Exploration and development at zinc and copper-zinc mines included the following: Diamond drilling, 39,668 feet; percussion drilling, 26,996 feet; drifting, 27,880 feet; raising, 5,433 feet; winzing, 25 feet; shaft sinking, 1,085 feet; inclining, 745 feet; and long hole drilling, 4,762 feet.

REVIEW BY COUNTIES

Mineral production was reported from 78 counties; the leading counties were Knox, Polk, Maury, Jefferson, and Davidson. In addition to the commodities listed in table 12, small quantities of oil and gas were produced; the county origin of these was undetermined.

Anderson.—Pocahontas Fuel Co. (Morco Colliery), Windrock Coal & Coke Co. (Windrock No. 2 mine), and Tennessee Auger Co. (No. 1 Strip mine) were the leading producers of the 33 active coal mines. Ralph Rogers & Co. Inc. (Oak Ridge quarry) and Anderson County Highway Department (Taylor's quarry No. 1) crushed limestone for concrete, roads, and stone sand. Lalite Corp. (Briceville mine) mined miscellaneous clay for lightweight aggregates. One oil well totaling 3,104 feet was drilled.

Bedford.—A & R Stone Co. Inc. (Shelbyville quarry) crushed limestone for concrete, roads, and agricultural stone (agstone). Virgil Owens collected a small quantity of gem stones (agate).

Benton.—Five mines produced sand for glass, molding, grinding, and polishing; the leading producer was Hardy Sand Co. (Silica and Camden mines). Memphis Stone & Gravel Co. and Camden Gravel Co. mined paving gravel.

Bledsoe.—Seven mines produced coal; the leading producers were B D S S Coal Co. (No. 1 mine), State Training & Vocational School (No. 3 mine), and Peacock Coal Co. (No. 1 mine).

TABLE 12.—Value of mineral production in Tennessee, by counties[1]

County	1961	1962	Minerals produced in 1962, in order of value[2]
Anderson	(3)	(3)	Coal, limestone, miscellaneous clay.
Bedford	(3)	(3)	Limestone, gem stones.
Benton	$1,094,997	$1,222,594	Sand and gravel.
Bledsoe	89,459	72,419	Coal.
Blount	(3)	(3)	Marble, limestone, iron ore.
Bradley	(3)	(3)	Limestone, sand and gravel.
Campbell	4,312,417	(3)	Coal, limestone, sandstone.
Cannon	(3)	(3)	Limestone.
Carroll	(3)	(3)	Sand and gravel.
Carter	(3)	(3)	Limestone, sandstone, gem stones.
Claiborne	1,123,804	(3)	Coal, limestone.
Clay	60,000	(3)	Limestone.
Cocke	45,000	50,000	Do.
Coffee	(3)	(3)	Limestone, gem stones.
Cumberland	(3)	1,804,915	Sandstone, limestone, coal, sand and gravel.
Davidson	9,735,992	11,042,515	Cement, limestone, phosphate rock, sand and gravel, lime, miscellaneous clay.
Decatur	(3)	(3)	Limestone, sand and gravel.
De Kalb	60,500	31,879	Limestone.
Fayette	211,254	----------	
Fentress	431,406	456,312	Coal, limestone, sandstone.
Franklin	(3)(4)	(3)	Cement, limestone, sandstone, sand and gravel, miscellaneous clay.
Giles	2,347,131	(3)	Phosphate rock, limestone.
Grainger	52,450	43,244	Marble.
Greene	(3)	(3)	Limestone, sand and gravel.
Grundy	826,364	1,022,075	Coal, limestone, sand and gravel.
Hamblen	491,182	(3)	Limestone.
Hamilton	7,586,328	7,957,159	Cement, limestone, sand and gravel, coal, miscellaneous clay.
Hancock	(3)	----------	
Hardeman	(3)	(3)	Sand and gravel.
Hardin	----------	(3)	Limestone.
Hawkins	133,282	(3)	Do.
Haywood	25,414	54,000	Sand and gravel.
Henderson	(3)	(3)	Do.
Henry	(3)	(3)	Ball clay, fuller's earth.

TABLE 12.—Value of mineral production in Tennessee, by counties [1]—Continued

County	1961	1962	Minerals produced in 1962, in order of value [2]
Hickman	(3)	(3)	Phosphate rock.
Humphreys	(3)	(3)	Limestone, sand and gravel.
Jefferson	(3)	(3)	Zinc ore, limestone.
Johnson	(3)	(3)	Limestone.
Knox	$19,656,387	$18,756,087	Cement, limestone, zinc ore, marble, lime, sand and gravel, miscellaneous clay.
Lauderdale	77,650	54,872	Sand and gravel.
Lawrence	29,059	(3)	Limestone.
Lincoln	120,438	(3)	Do.
Loudon	(3)	(3)	Barite, sand and gravel, miscellanous clay.
Macon	192,116	115,000	Limestone.
Marion	(3)	(3)	Cement, coal, limestone.
Marshall	(3)	(3)	Limestone.
Maury	12,526,212	(3)	Phosphate rock, limestone.
McMinn	(3)	(3)	Limestone, barite.
McNairy	(3)	(3)	Sand and gravel.
Meigs	(3)	(3)	Limestone.
Monroe	(3)	(3)	Limestone, sand and gravel.
Montgomery	(3)	595,957	Limestone.
Morgan	995,345	(3)	Coal, sandstone.
Obion	93,936	45,553	Sand and gravel.
Overton	(3)	(3)	Limestone, coal.
Pickett		60,959	Do.
Polk	(3)	(3)	Copper, pyrites, zinc ore, silver, lead, gold.
Putnam	(3)	(3)	Coal, limestone, sand and gravel.
Rhea	(3)	(3)	Limestone, coal.
Roane	(3)	(3)	Limestone, iron ore.
Robertson	(3)	(3)	Limestone.
Rutherford	(3)	(3)	Do.
Scott	1,408,101	1,485,370	Coal.
Sequatchie	(3)	(3)	Coal, limestone.
Sevier	249,601	(3)	Limestone, sand and gravel.
Shelby	1,117,834	1,413,726	Sand and gravel, miscellaneous clay.
Smith	(3)		
Stewart	(3)	(3)	Sand and gravel.
Sullivan	(3)	(3)	Cement, limestone, miscellaneous clay.
Sumner	419,002	439,238	Limestone.
Tipton	294,116	264,066	Sand and gravel.
Unicoi	498,371	(3)	Do.
Union	287,900	(3)	Marble, limestone.
Van Buren	528,868	793,488	Coal.
Warren	(3)	(3)	Limestone.
Washington	459,730	(3)	Limestone, miscellaneous clay.
Wayne	(3)	(3)	Sand and gravel, limestone.
Weakley	(3)	(3)	Ball clay.
White	321,120	328,920	Limestone.
Williamson	(3)	(3)	Phosphate rock, limestone.
Wilson	735,208	(3)	Limestone.
Undistributed [5]	[4] 82,073,026	105,919,652	
Total	[4] 150,711,000	154,030,000	

[1] The following counties are not listed because no production was reported: Cheatham, Chester, Crockett, Dickson, Dyer, Gibson, Houston, Jackson, Lake, Lewis, Madison, Moore, Perry, and Trousdale.
[2] Petroleum and natural gas value is not listed by counties as data are not available; value included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Revised figure.
[5] Includes value of petroleum and natural gas and values indicated by footnote 3.

Blount.—John J. Craig Co. (Hamil, Marmor, Lee, and Crisp quarries), Tennessee Marble Co. (Endsley quarry), and Gray Knox Marble Co. (Brown and French Pink quarries) quarried dimension marble for rough and dressed building stone and dressed monumental stone. John J. Craig Co. crushed marble for terrazzo and other uses. Lambert Bros. Division of Vulcan Materials Co. (Maryville quarry) crushed limestone for concrete, roads, and agstone. Big Flag Springs Mining Co. mined brown iron ore at the Wilson mine.

Bradley.—Bradley Limestone Co. Inc. (Welch quarry) and Bradley County Highway Department crushed limestone for concrete, roads,

and agstone. Hiwassee Sand Co. Inc. mined sand for structural and paving uses.

Campbell.—Sixty mines produced coal; the leading producers were Rich Gap Coal Corp. (Rich Gap Strip mine), Dixie Pine Coal Co. Inc. (No. 1 Strip mine), and Hurricane Mountain Coal Co. (No. 2 mine). Key Limestone (LaFollette quarry) and Jellico Stone Co. Inc. (Jellico quarry) crushed limestone for concrete, roads, agstone, and stone sand. White Silica Sand Co. (Silica quarry) crushed sandstone for concrete, roads, abrasives, and other uses.

Cannon.—Woodbury Stone Co. (Norvell quarry) crushed limestone for concrete, roads, and agstone.

Carroll.—Hardy Sand Co. (Bruceton mine) mined sand for grinding and polishing, and fertilizer filler.

Carter.—Watauga Stone Co. (Watauga quarry) crushed limestone for concrete, roads, railroad ballast, and stone sand. Tipton Construction Co. Inc. (Elizabethton quarry) crushed sandstone for miscellaneous uses. W. B. Pruitt collected a small quantity of gem stones (dolomite).

Cheatham.—One oil well totaling 800 feet was drilled.

Claiborne.—Acorn Coal Co. (No. 2 Strip and No. 1 Auger mines) and Harris Branch Coal Co. (No. 1 mine) were the leading producers of the 20 active coal mines. Lambert Bros. (Tazewell quarry) crushed limestone for concrete and roads.

Clay.—Dixie Limestone Co. (Celina quarry) crushed limestone for concrete, roads, and agstone. Five oil wells totaling 3,697 feet were drilled.

Cocke.—Cocke County Highway Department (Smith quarry) crushed limestone for concrete and roads.

Coffee.—Ralph Rogers & Co. Inc. and Coffee County Highway Department crushed limestone for concrete, roads, agstone, and stone sand. Virgil Owens collected a small quantity of gem stones (agate and jasper).

Cumberland.—Eight companies quarried dimension sandstone for rough architectural, sawed and dressed building stone, and flagging. The leading producers were Crab Orchard Stone Co. Inc. (Peck quarry), Tennessee Stone Co. (McGuire quarry), and Turner Bros. Stone Co. Inc. Turner Bros. Stone Co. Inc. produced a small quantity of crushed sandstone for refractory use. Southern States Lime Corp. (Crab Orchard mine) and Cumberland County Highway Department (County quarry) produced limestone for riprap, concrete, roads, fluxing stone, railroad ballast, agstone, glass, paper, rock dust for coal mines, filter beds, mineral food, and other uses. Eight mines produced coal; the leading producers were Clear Creek Coal Co. (No. 1–A mine), Fields Coal Co. (No. 1 mine), and Smith & Welch Coal Co. (No. 1 mine). Potter Sand & Gravel Co. (Crossville mine) mined structural and paving sand and gravel.

Davidson.—Davidson County ranked fifth in the State in total value of mineral production. Marquette Cement Mfg. Co. produced masonry and portland cements at the Nashville mill throughout the year. Seven quarries produced limestone for riprap, concrete, roads, agstone, asphalt filler, and fertilizer filler; the leading pro-

ducers were Lambert Bros. (Hermitage and Danley quarries) and Hoover, Inc. (Nashville quarry).

Monsanto Chemical Co. mined phosphate rock. Ingram Materials, Inc. (Nashville mine) and T. L. Herbert & Sons mined structural and paving sand and gravel. Victor Chemical Works produced lime for industrial uses. W. G. Bush & Co. Inc. (Nashville mine) mined miscellaneous clay for cement and heavy clay products. Tennessee Products & Chemical Corp. expanded crude perlite from Western States at the Nashville plant. One oil well totaling 700 feet was drilled.

Decatur.—Western Materials, Inc. (Parsons quarry) crushed limestone for concrete, roads, and agstone. Teague Bros. Sand & Gravel Co. and Tinker Sand & Gravel Co. mined structural sand and gravel.

De Kalb.—De Kalb County Highway Department (Chapman Hollow quarry) crushed limestone for concrete and roads.

Dickson.—Three oil wells totaling 3,391 feet were drilled.

Fayette.—One oil well totaling 2,126 feet was drilled.

Fentress.—Twenty-three mines produced coal; the leading producers were Murphy Coal Co. (East Fork mine), Hollis Miller Coal Co. (No. 4 mine), and Sells & Gibson Coal Co. (P No. 2 mine). Frogge & Williams, Inc. (Wright quarry) crushed limestone for concrete, roads, and agstone. Kentucky-Tennessee Stone Co. (Jamestown quarry) quarried dimension sandstone for rough architectural stone and flagging.

Franklin.—Marquette Cement Mfg. Co. produced masonry and portland cements at the Cowan mill throughout the year. Cowan Stone Co. (Cowan and Anderson quarries), Marquette Cement Mfg Co. and Franklin County Highway Department (Bostick quarry) produced limestone for riprap, concrete, roads, railroad ballast, agstone, glass, cement, and other uses. Sewanee Silica Co. (Monteagle quarry) crushed sandstone for concrete, roads, abrasives, foundry, glass, pottery, and other uses. Estill Springs Sand-Gravel Co. mined structural and paving sand and gravel. Marquette Cement Mfg. Co. (Cowan mine) mined miscellaneous clay for use in cement manufacture.

Giles.—Monsanto Chemical Co. and International Minerals & Chemical Corp. mined phosphate rock. Cedar Grove Lime Co. (Cedar Grove quarry) crushed limestone for concrete, roads, and agstone. One oil well totaling 825 feet was drilled.

Grainger.—Imperial Black Marble Corp. quarried dimension marble for rough building stone at the Thornhill quarry.

Greene.—Malone Bros. Quarry, Inc., Agriculture Lime Co. Inc., and Greene County Highway Department produced limestone for riprap, concrete, roads, and agstone. Nolichucky Sand Co. (Bewley mine) and Buster Sand Co. (Greenville mine) mined structural sand and gravel.

Grundy.—Five mines produced coal; the leading producer was Ramsey Coal Co. (No. 1 Strip mine). Cumberland Mountain Sand Co. (McMinnville mine) mined structural and paving sand. Viola White Lime Co. (Old State quarry) crushed limestone for concrete, roads, and agstone.

Hamblen.—White Pine Stone Co. (Hamblen quarry) crushed limestone for concrete and roads.

Hamilton.—Signal Mountain Portland Cement produced masonry and portland cements at the Signal Mountain mill throughout the year. Chattanooga Rock Products (Chattanooga quarry) crushed limestone for concrete, roads, and agstone. Dixie Sand & Gravel Corp. mined structural sand and gravel. Six mines produced coal; the leading producer was C R & B Coal Co. (No. 1 Strip mine). Key-James Brick Co. mined miscellaneous clay for heavy clay products.

Hardeman.—Tri-State Sand Co. (Saulsbury mine) mined structural sand.

Hardin.—Hardin Limestone Co. crushed limestone for concrete, roads, and agstone. Tennessee River Pulp & Paper Co. reclaimed lime for industrial uses.

Hawkins.—Lambert Bros. (McCloud quarry) crushed limestone for concrete and roads.

Haywood.—Haywood County Highway Department (County mine) mined paving gravel.

Henderson.—Ayers Mineral Co. (Zane mine) mined molding sand. One oil well totaling 950 feet was drilled.

Henry.—Kentucky-Tennessee Clay Co. (Tennessee mine), H. C. Spinks Co. Inc., and Laird Brick Co. (Puryear mine) mined ball clay for whiteware, floor and wall tile, refractories, heavy clay products, and exports. Southern Clay Co. Inc. and Tennessee Absorbent Clay Co. mined fuller's earth for absorbent uses.

Hickman.—M. C. Boyle Phosphate Co. mined phosphate rock at the Bratton mine for agricultural uses.

Humphreys.—Lambert Bros. (Rock Hill quarry) crushed limestone for concrete, roads, and agstone. Sangravel Co. Inc. (Johnsonville mine) mined structural and paving sand and gravel.

Jefferson.—Jefferson County ranked fourth in the State in total value of mineral production. American Zinc Co. of Tennessee (Young, Coy, and Grasselli mines), Tennessee Coal & Iron (Zinc Mine works), and New Jersey Zinc Co. (Jefferson City mine) recovered zinc ores. Limestone was produced by the Jefferson County Highway Department and also recovered as a byproduct from zinc mines; this material was used for concrete, roads, railroad ballast, agstone, and stone sand.

Johnson.—Maymead Lime Co. Inc. (Dowell and Lunceford quarries) crushed limestone for concrete, roads, and agstone.

Knox.—Knox County led the State in total value of mineral production. Ideal Cement Co. produced masonry and portland cements at the Knoxville mill throughout the year. Nine quarries and one mine produced limestone for riprap, concrete, roads, agstone, cement, lime, and other uses; the leading producers were Lambert Bros. (Dixie Lee, Lamon, City, and Halls quarries) and Ideal Cement Co. (Knoxville quarry). American Zinc Co. of Tennessee (Mascot No. 2 mine) mined zinc ore and recovered limestone as a byproduct.

Appalachian Marble Co. (Bond and Appalachian quarries), Gray Knox Marble Co. (Gray Knox quarry), and Tennessee Marble Co.

(Eagle quarry) quarried dimension marble for rough and dressed building stone and dressed sawed monumental stone. Appalachian Marble Co. and Knoxville Crushed Stone Co. Inc. (Stone Road quarry) crushed marble for terrazzo and other uses. Williams Lime Mfg. Co. and Standard Lime & Cement produced lime for building, chemical, and industrial uses. Knoxville Sand & Gravel Co. and Oliver King Sand & Lime Co. Inc. dredged sand and gravel from the Tennessee River for structural, paving, grinding and polishing, engine, and other uses. Shalite Corp., General Shale Products Corp., and Ideal Cement Co. mined miscellaneous clay for lightweight aggregates, cement, and heavy clay products.

Lauderdale.—Lauderdale County Highway Department mined paving gravel.

Lawrence.—Lawrence County Limestone Co. (Jaco quarry) crushed limestone for concrete, roads, and agstone.

Lincoln.—Clark & Stephenson (Fayetteville quarry) and Lincoln County Highway Department crushed limestone for concrete, roads, and agstone.

Loudon.—B. C. Wood mined barite at the Cedar Fork mine. Brooks Sand-Gravel mined structural sand. Old Hickory Brick Co. Inc. (Greenback mine) mined miscellaneous clay for heavy clay products.

Macon.—Dixon-Stubblefield Limestone Co. (Hillsdale quarry) crushed limestone for concrete, roads, and agstone.

Marion.—Penn-Dixie Cement Corp. produced portland cement at the Richard City mill throughout the year. Fifty-five mines produced coal; the leading producers were Thomas Coal Co. (No. 4–51 mine), Grundy Mining Co. (Gray's Creek No. 11 mine), and Tennessee Consolidated Coal Co. (Coal Valley mine). Signal Mountain Portland Cement (Bennetts Lake quarry), Penn-Dixie Cement Corp. (Richard City quarry), and Chattanooga Rock Products (Marion quarry) crushed limestone for concrete, roads, agstone, and cement.

Marshall.—Lewisburg Limestone Co. (Lewisburg quarry) crushed limestone for concrete, roads, and agstone.

Maury.—Maury County ranked third in the State in total value of mineral production. Seven operators produced phosphate rock; the leading producers were Hooker Chemical Corp., Victor Chemical Works, and Monsanto Chemical Co. Columbia Rock Products Corp. (Theta Pike mine) crushed limestone for concrete, roads, agstone, and stone sand.

McMinn.—Floyd D. Webb Stone Co. (Webb quarry) and McMinn County Highway Department (Athens quarry) crushed limestone for concrete and roads. James M. Godsey (Athens and Calhoun mines), and Carl Richesin Mining Co. (Niota mine), mined barite. Bowaters Southern Paper Corp. reclaimed lime for industrial uses.

McNairy.—Worsham Bros. mined sand and gravel for structural, paving, and other uses.

Meigs.—Ten Mile Stone Co. Inc. (Ten Mile quarry) and Meigs Stone Co. (Posey quarry) produced limestone for riprap, concrete, roads, and agstone.

Monroe.—Creighead Limestone Co. (Creighead quarry) and Monroe County Highway Department (Madisonville quarry) crushed limestone for concrete, roads, and agstone. Vonore Sand Co. (Vonore

mine) and Tennessee River Sand Co. (Wood & Johnson mine) mined structural and paving sand.

Montgomery.—Simpson Stone Co. (Simpson quarry) and Clarksville Stone Co. (Clarksville mine) crushed limestone for concrete, roads, and agstone.

Morgan.—Twenty-seven mines produced coal; the leading producers were Brushy Mountain Coal Mines (No. 7 mine), G & F Coal Co. Inc., (G & F Strip mine), and W. R. Brooks Coal Co. (Mossy Grove Strip mine). Sunbright Stone Co. Inc. quarried dimension sandstone for rough building stone and flagging.

Obion.—Obion County Highway Department mined paving gravel.

Overton.—Livingston Limestone Co. (East and South quarries) crushed limestone for concrete, roads, and agstone. Twenty-one mines produced coal; the leading producers were Bud's Coal Co. (New No. 1 mine) and Three Bros. Coal Co. (No. 1 mine). Two oil wells totaling 1,386 feet were drilled.

Pickett.—T & K Coal Co. (No. 1 Strip mine) was the only active coal producer. Pickett County Highway Department crushed limestone for concrete and roads. Four oil wells totaling 3,652 feet were drilled.

Polk.—The county ranked second in the State in total value of mineral production. Tennessee Copper Co. mined mixed sulfide ore at the Boyd, Calloway, Cherokee, Eureka, and Mary mines. The ore was concentrated at the London flotation mill and yielded copper, iron (pyrite), lead, and zinc concentrates; gold and silver were recovered as byproducts from smelting the copper, lead, and zinc concentrates; the iron concentrate was roasted, yielding sulfur dioxide, which was used mainly in manufacturing sulfuric acid, and iron oxide, which was sintered for use by iron and steel plants. Development work was continued at the Cherokee Shaft, and initial production was reported.

Putnam.—Clinchfield Coal Co. (Meadow Creek mine) was the only active coal producer. R. E. Poteet (Poteet quarry) and Putnam County Highway Department crushed limestone for concrete, roads, and agstone. Sand, Inc. (Monterey mine) mined structural and paving sand. Three oil wells totaling 4,180 feet were drilled.

Rhea.—Rhea County Limestone Co. (Dayton quarry) crushed limestone for concrete and roads. Four mines produced coal; the leading producer was Rocky Creek Coal Co. (RC No. 1 mine).

Roane.—A. B. Long Quarries, Inc. (Swan Pond quarry) and Lambert Bros. (Rockwood quarry) produced limestone for riprap, concrete, roads, agstone, and stone sand. Rockwood Mining Corp. (New Chamberlain mine) mined red iron ore. Tennessee Products & Chemical Corp. produced pig iron and sinter at the Rockwood plant.

Robertson.—Porter Brown Limestone Co. (Springfield No. 1 quarry) crushed limestone for concrete, roads, and agstone. Five oil wells totaling 6,068 feet were drilled.

Rutherford.—A & R Stone Co. Inc. (Murfreesboro quarry) crushed limestone for concrete, roads, and agstone.

Scott.—Twenty-eight mines produced coal; the leading producers were Allen Bros. Coal Co. (Hines Branch Strip mine), Whitley Strip

Mining Co. Inc. (No. 1 Strip mine), and Poor Mountain Coal Co. (No. 1 mine). Six oil wells totaling 8,254 feet were drilled.

Sequatchie.—Forty mines produced coal; the leading producers were Cates Coal Co. (No. 7–202 mine), Tracy Coal Co. (No. 7–217 mine), and Kelley Creek Coal Co. (No. 7–219 mine). Dunlap Stone Co. (Sequatchie quarry) crushed limestone for concrete, roads, and agstone.

Sevier.—Lambert Bros. (Sevierville quarry) and Sevier County Highway Department crushed limestone for concrete and roads. Cameron Sand & Gravel Co. Inc. (Boyds Creek and Kodak mines) mined structural sand.

Shelby.—Five mines produced sand and gravel for structural and paving uses; the leading producers were Cordova Sand & Gravel Co. (Cordova mine) and Marquette Cement Mfg. Co. (Tennessee mine). John A. Denies Sons Co. mined miscellaneous clay for heavy clay products. Union Carbide Olefins Co. reclaimed lime for industrial uses.

Stewart.—T. L. Herbert & Sons, Inc. (Dover mine) mined structural sand and gravel.

Sullivan.—Penn-Dixie Cement Corp. produced masonry and portland cements at the Kingsport mill throughout the year. Lambert Bros. (New Kingsport quarry) and Limestone Products Corp. (rockway quarry) crushed limestone for concrete, roads, and agstone. General Shale Products Corp. (Kingsport mine) and Penn-Dixie Cement Corp. mined miscellaneous clay for use in cement and heavy clay products. The Mead Corp. reclaimed lime for industrial uses.

Sumner.—Pilot Knob Limestone Co. (Pilot Knob mine), Ralph Rogers & Co. Inc., and Sumner County Highway Department produced limestone for riprap, concrete, roads, and agstone. Six oil wells totaling 5,301 feet were drilled.

Tipton.—Owens Sand & Gravel Co. (Covington mine) and Tipton County Highway Department mined structural and paving sand and gravel.

Unicoi.—Brooks Sand-Gravel (Erwin mine) mined structural sand and paving and railroad ballast gravel. The Feldspar Corp. ground feldspar for glass, pottery, and enamel uses at the Erwin Grinding plant. Carolina-Southern Mining Co. Inc. (Kingsport Mica Grinding plant) ground mica for welding rods and joint cement uses.

Union.—Tennessee Marble Co. (Luttrell No. 3 quarry) quarried dimension marble for rough and dressed building stone. Union County Highway Department crushed limestone for concrete and roads.

Van Buren.—Fourteen mines produced coal; the leading producers were Walden Ridge Coal Co. (Studer No. 1 Strip mine) and Waters Coal & Construction Corp. (Nos. 2 and 4 Strip mines).

Warren.—Warren Limestone Co. (Warren mine) crushed limestone for concrete, roads, and agstone.

Washington.—Washington County Highway Department (Gray, Taylor Bridge, Dillow, Boones Creek, and Corby quarries) crushed limestone for concrete and roads. General Shale Products Corp. (Johnson City mine) mined miscellaneous clay for heavy clay products.

Wayne.—Hassell & Dowdy Sand & Gravel (Baker mine) mined structural sand and gravel. Universal Limestone Co. (Waynesboro quarry) crushed limestone for concrete, roads, and agstone.

Weakley.—United Clay Mines Corp. (No. 6 mine), Bell Clay Co. (Collins mine), and H. C. Spinks Clay Co., Inc., mined ball clay for whiteware, enameling, floor and wall tile, firebrick and block, and heavy clay products. Two oil wells totaling 2,772 feet were drilled.

White.—Sparta Limestone Co., Farmers Limestone Co., and White County Highway Department crushed limestone for concrete, roads, and agstone.

Williamson.—Monsanto Chemical Co. and Tennessee Valley Authority mined phosphate rock. Lambert Bros. (Franklin and Williamson quarries) and Williamson County Highway Department crushed limestone for concrete, roads, and agstone. One oil well totaling 1,603 feet was drilled.

Wilson.—Marquette Cement Mfg. Co. (Martha quarry) and Wilson County Rock Products, Inc. (Lebanon and Wilson quarries) crushed limestone for concrete, roads, and cement.

The Mineral Industry of Texas

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and Bureau of Economic Geology, The University of Texas, for collecting information on all minerals except fuels.

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THE MINERAL industry of Texas maintained its important position in the economy of the State, the Southwest region, and the Nation in 1962 with an output of minerals valued at $4.3 billion, about one-fourth of the U.S. total. Texas was the principal domestic producer of petroleum, natural gas, natural gas liquids, sulfur, shell, and magnesium metal. Other minerals produced in significant quantities were bromine, cement, clay, gypsum, lime, salt, sand and gravel, and stone. A total of 26 minerals and mineral fuels was produced.

The 2 percent increase in mineral value coincided with and contributed to the larger 10 percent increase in business activity measured by the business index of the Bureau of Business Research, The University of Texas.[4] It was evident from these major indexes that the industrial and business climate was better than in 1961.

Mineral fuels continued to dominate the mineral industry of the State and were responsible for more than 92 percent of the total mineral value. Mineral resources are widely distributed over the State and 236 of the 254 counties reported mineral output. Mineral fuels—petroleum, natural gas, natural gas liquids, and lignite—were reported from 208 counties, nonmetals from 149, and metals from 6. Seven counties reported mineral production value greater than $100 million.

Part of the mineral industry recovered secondary products from locally produced minerals, such as recovered sulfur and carbon black from natural gas and refinery residues, and/or processed minerals and mineral fuels from other States and foreign countries.

Most of the mineral fuels, both crude and refined, were destined for markets outside the State. Pipelines and barges carried many of these products to domestic markets. Ocean tankers transported significant quantities of petroleum products to eastern seaboard markets and foreign ports. Out-of-State markets also were prin-

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[4] Texas Business Review, February 1963, p. 21.

TABLE 1.—Mineral production in Texas [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland—thousand 376-pound barrels	25,101	$80,808	26,204	$83,162
Masonry—thousand 280-pound barrels	851	2,529	926	2,774
Clays [2]—thousand short tons	3,786	5,737	3,744	5,634
Gem stones	(3)	150	(3)	150
Gypsum—thousand short tons	1,074	[4] 3,832	1,120	3,956
Helium—thousand cubic feet	173,066	3,196	245,623	8,552
Lime—thousand short tons	[4] 790	[4] 8,703	1,047	11,999
Natural gas—million cubic feet	5,963,605	733,523	6,080,210	747,866
Natural gas liquids:				
Natural gasoline and cycle products—thousand gallons	3,111,427	214,279	3,205,517	233,345
LP gases—do	4,768,222	185,558	5,012,291	189,382
Petroleum (crude)—thousand 42-gallon barrels	939,191	2,791,377	[5] 936,508	[5] 2,796,136
Salt—thousand short tons	4,695	17,682	5,553	19,485
Sand and gravel—do	27,398	30,691	30,076	33,097
Stone—do	38,316	45,874	38,067	48,988
Sulfur (Frasch-process)—thousand long tons	2,730	62,720	2,655	57,297
Talc and soapstone—short tons	78,214	376	73,635	387
Value of items that cannot be disclosed: Asphalt (native), barite, bromine, clay (fuller's earth), coal (lignite), feldspar (1961), graphite, iron ore (usable), magnesium chloride (for metal), magnesium compounds (except for metal), pumice, sodium sulfate, and uranium ore		50,923		58,774
Total		[4] 4,237,958		4,300,984

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producer).
[2] Excludes certain clays, value included with "Value of items that cannot be disclosed."
[3] Weight not recorded.
[4] Revised figure.
[5] Preliminary figure.

cipal consumers of ferrous, base-, and light-metal smelter products. Nonmetallic commodities, excluding sulfur, depended largely upon local and intrastate markets.

Crude oil refining and petrochemical manufacture continued to be an important part of the economy of the State and of the Nation. Oil refining capacity was 2.7 million barrels per day, 27 percent of the national daily capacity of nearly 10 million barrels. Construction of new plants and new facilities at existing petrochemical plants kept Texas among the three principal U.S. producers.

The world's largest ethylene plant, that of Monsanto Chemical Co., at Chocolate Bayou in Brazoria County, began operating in late 1962.

The theory of a broad arc of Edwards Reef oil from the Rio Grande across Texas and Lousiana into southern Mississippi appeared to be substantiated with a gas discovery in the Gulf Coast province in De Witt County and an oil discovery in Houston County in east Texas. The Eliza J. Smith gas discovery by Atlantic Refining Co. in De Witt County deployed the Deep Edwards into the Gulf Coast province while the Delhi-Taylor oil discovery, the No. 1 D. D. Hart in Houston County, extended the Deep Edwards into east Texas.

An oil well that began pumping drilling mud rather than oil in the giant East Texas oilfield in April 1961 marked the beginning of

State and Federal investigations concerning oil that was produced from deviated (slanted) wells. Agencies involved in the investigation were Texas Railroad Commission, State Attorney General's office, Texas Department of Public Safety, and Federal Petroleum Board. By the end of 1962, 243 wells had been found to deviate more than the 3° allowed by Texas law. Texas Railroad Commission, the State oil regulatory agency, applied stricter oil and gas drilling regulations. Inclination tests—to determine how many degrees a well deviated from the vertical—were required by the Commission for all new wells and any existing wells that were deepened. An operator may also ask the Commission to order inclination or directional tests if he could show the probability that another well in the same field was illegally deviated. The complaining operator must pay the costs of the tests and for any damages to the suspected well.

The 30-year-old calendar-day system of allocating Texas oil production to market demand was discarded by Texas Railroad Commission in December for a more flexible system based on percentages of production. The new system was to be applied to January 1963 oil production.

An example of modern engineering concepts applied to the early development of a major new oilfield was evolving in the Fairway field of Anderson and Henderson Counties in east Texas. A high-pressure miscible drive gas-injection operation was conceived to maintain reservoir pressure in the James lime formation to raise primary recovery estimated at 17 to 21 percent to an ultimate recovery of 52 to 63 percent of the oil in place. The program required the cooperative agreements of producers, landowners, and the Railroad Commission. Benefits to be derived from the program included reduced drilling and production costs, delineation of the producing area early in the life of the field, and more lease and royalty owner participation earlier in production.

The Nation's largest oil products line, a 1,600-mile pipeline with another 1,000 miles of spur lines, costing $350 million, was being built by Colonial Pipeline Co. Nine oil companies began constructing a 36- to 22-inch pipeline from Houston to Staten Island, N.Y., in mid-1962, with completion scheduled for late 1963. The pipeline would move gasoline, diesel fuel, and other refined products from Gulf Coast refineries in Texas and Louisiana at a rate of 4 miles per hour to southeastern, eastern, and New York City markets.

Projects totaling $32.8 million to deepen the Intracoastal Canal to 16 feet from the Mississippi River to the Houston Ship Channel and to build 12-foot channels through Matagorda and Corpus Christi Bay were submitted by the U.S. Army Corps of Engineers for Congressional approval.

The Federal Government's helium conservation program initiated in 1960 was nearing fulfillment in 1962 with completion of the Government's 425-mile pipeline and construction of five private helium recovery plants in Texas and Kansas. The program would recover more than 62 billion cubic feet of helium that might otherwise be lost. The crude helium, 60 percent helium and 40 percent nitrogen, recovered at these private facilities would be stored in the Govern-

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ment-owned Cliffside gasfield near Amarillo and eventually refined to commercial standards at Government plants.

Employment.—Mining employment in Texas rose 1 percent to 501,100 workers, according to Texas Employment Commission. The work week advanced 1 percent to average 42.5 hours in 1962, and average weekly wages rose 3 percent to $114.48. Employment in the oil and gas industry improved more than that of the total mining sector—2 percent to 114,500 employees. Average weekly wages of these workers rose 2 percent to $116.33.

TABLE 2.—Employment data in mining and related industries

Industry	Employment		Weekly hours worked		Weekly earnings	
	1961 [1]	1962 [2]	1961	1962	1961	1962
Manufacturing	487,000	501,100	41.1	41.4	$92.48	$96.05
Primary metals	24,100	25,500	40.4	40.5	109.48	113.00
Stone, clay, and glass products	23,100	23,900	40.5	44.6	73.71	84.29
Chemicals	45,100	46,600	40.8	41.6	125.26	129.79
Petroleum and related industries	40,400	39,300	40.8	41.5	129.34	132.39
Transportation equipment	51,400	50,200	40.6	41.0	110.03	116.44
Nonmanufacturing	2,057,100	2,129,600				
Mining	120,600	120,800	42.1	42.4	111.57	114.48
Crude petroleum	[3] 113,900	[3] 114,500	42.1	42.3	113.67	116.33
Other mining	6,700	6,300	39.9	40.0	118.10	117.60
Construction	164,700	173,800				

[1] Revised figures.
[2] Preliminary figures.
[3] Includes natural gas.

Source: Texas Employment Commission in cooperation with U.S. Bureau of Labor Statistics.

Government Programs.—The State legislature scheduled hearings on reducing the severance tax rate on sulfur by 26 percent or to $1.03 per long ton. This action should help the competitive position of the State's sulfur industry.

Supplementing a nationwide search by the Bureau of Mines for new sources of beryllium, tellurium, selenium, germanium, and other trace elements, preliminary field reconnaissance was conducted during 1962 on some areas with geological potentials in Brewster, Presidio, Culberson, and Hudspeth Counties. The results of cooperative semiquantitative spectrographic analyses of trace elements in coal and lignite beds were published in 1962 in a project report, Mineral Resource Circular No. 43, Bureau of Economic Geology, The University of Texas.

The U.S. Army Corps of Engineers, Southwestern Division, had a total of 43 reservoir projects authorized, 22 under construction, and 37 in operation. Eight dams were under construction in Texas in 1962.

The saline water conversion plant at Freeport continued its study of costs and equipment stability in making potable water from sea water. Rated capacity of the plant was 1 million gallons of fresh water per day, half of which was purchased by The Dow Chemical Co. for its chemical plant, and the other half went to the city of Freeport to supplement its municipal water supply.

A project to conserve and develop fish and wildlife of the Sanford Reservoir by the Federal Bureau of Reclamation, the Federal Fish

and Wildlife Service, and the Texas Game and Fish Commission was approved in late 1962. The project provided access areas and public use facilities at six key locations around Sanford Reservoir. The Canadian River project would furnish 103,000 acre-feet of municipal and industrial water to 11 cities in the Texas Panhandle and High Plains area—Amarillo, Borger, Brownfield, Lamesa, Levelland, Lubbock, O'Donnell, Pampa, Plainview, Slaton, and Tahoka.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The oil and gas industry experienced heterogeneous developments in 1962, all of which were influenced by national and international trends. Changes in demand patterns showed that several important markets of refined products—space heating, industrial uses, and power plants—substituted larger quantities of natural gas for established fuels. Gasoline demand improved with the rise in new car sales. Texas oil output had not followed the national demand pattern for a number of years, because natural gas and natural gas liquids have assumed a larger share of the domestic market at the expense of crude oil. Table 3 illustrates trend changes.

TABLE 3.—Production trends of crude oil, natural gas, and natural gas liquids for select years

(Million barrels of oil equivalent)

Year	Production [1]				Percentage of—						
					Annual total			Change of reported year			
	Total	Oil	Gas	Liquids	Oil	Gas	Liquids	Oil	Gas	Liquids	Total
1940	699	493	190	16	70.5	27.1	2.4				
1950	1,457	830	558	69	57.0	38.3	4.7	68.4	193.7	331.3	108.4
1956	2,116	1,108	892	116	52.4	42.1	5.5	33.5	59.9	68.1	45.2
1960	2,107	927	1,052	128	44.0	49.9	6.1	−16.3	17.9	10.3	−0.4
1961	2,141	939	1,065	137	43.9	49.7	6.4	1.3	1.2	7.0	1.6
1962	2,169	937	1,089	143	43.2	50.2	6.6	0.2	2.3	4.4	1.3

[1] One barrel of crude oil equivalent to 5,600 cubic feet of natural gas or 57.6 gallons of natural gas liquids, a composite of 52.7 gallons of natural gasoline and 60.8 gallons of LP gases.

Texas crude oil producers have lost fuels markets to natural gas and natural gas liquids since 1940. At that time, crude oil represented 71 percent of the mineral fuels output, natural gas 27 percent, and liquids 2 percent. By 1962 crude oil output had decreased to 43 percent of the fuels output with natural gas accounting for 50 percent of the market.

Texas crude oil production changed little although total domestic crude output advanced 2 percent. Natural gas output in Texas rose 2 percent and liquids 4 percent, compared with 5 percent and 3 percent increases, respectively, for domestic output. Crude oil and natural gas output as percentages of domestic output each declined from 1961 ratios—only natural gas liquids had a small rise.

Total reserves of mineral fuels in Texas declined less than 1 percent in 1962 and total domestic reserves increased 1 percent, as shown in table 5. Oil and gas drilling in Texas increased 1 percent compared with a 2 percent decline in domestic drilling. The number of multiple well completions continued to rise. The State and Nation's first octuple well proved seven gas zones and one oil zone. Two wells were completed with six pays each, one with six gas zones and one with one gas zone and five oil zones. The 1962 record of multiple completions, according to the Oil & Gas Journal, is shown in table 6.

Texas Railroad Commission issued a basic 40-acre Statewide well-spacing order changing the 20-acre regulation which had been in effect since 1944. Effective October 1, the rule forbade the drilling of wells in the same tract within 1,200 feet of each other or within 467 feet of property lease or subdivision lines.

The petrochemical industry added several new plants and facilities to existing plants to maintain its dominant position in national capacity. Additional markets for the products of the State's refining industry were in the future with the construction of a large products pipeline starting at Houston and terminating in New York and connecting with urban markets in southeastern and eastern seaboard States.

Carbon Black.—There were 21 carbon black plants operating, 14 were furnace-type plants located in 10 counties and 7 were channel-type located in 7 counties. Volume of natural gas used in producing carbon black declined for the eighth consecutive year.

Production of carbon black from petroleum liquids amounted to 897 million pounds, and from natural gas, 210 million pounds. Average carbon black yield from liquids was 4.7 pounds per gallon in contrast to 2.5 pounds recovered per thousand cubic feet of natural gas. Furnace blacks averaged 6.72 cents per pound and channel blacks 12.20 cents per pound.

Portable carbon black plants that could be dismantled, rebuilt, and returned to operation in 12 days were planned for Newton and Comanche Counties. Each plant would be a compact unit consisting of 12 carbon black generators (each generator processing 125,000 to 140,000 cubic feet of gas per day); an auger conveyor; a pulverizer; a pelletizer; bagging units; and storage tanks. This type of plant could provide outlets for shut-in gas and/or casinghead gas which was being flared.

Helium.—Production of helium from the two Government plants in Texas rose 42 percent in volume. Most of the increase was caused by accelerated requirements of Government defense, space exploration, and nuclear energy programs in which helium was an essential component. The Government helium conservation program under the Helium Act amendments of 1960 became a reality with completion of the 425-mile Government pipeline from Bushton, Kans., to the Cliffside gas field north of Amarillo, Tex., and the near completion of five private helium recovery plants.

TABLE 4.—Comparison of mineral fuels production in Texas and the United States

Fuel	Production [1] as oil equivalent				Percent of fuels				Texas percent of United States		Percent change from 1961	
	Texas		United States		Texas		United States					
	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962	Texas	United States
Crude oil	939	937	2,622	2,676	43.9	43.2	49.9	49.3	35.8	35.0	−0.2	+2.0
Natural gas	1,065	1,089	2,367	2,478	49.7	50.2	45.1	45.7	45.0	43.9	+2.3	+4.7
Natural gas liquids	137	143	264	272	6.4	6.6	5.0	5.0	51.9	52.6	+4.4	+3.0
Total equivalent	2,141	2,169	5,253	5,426	100	100	100	100	40.8	40.0	+1.3	+3.3

[1] Million barrels of oil equivalent, derived by gas and liquids factors reported in table 3.

TABLE 5.—Fuels reserves ratio to production in Texas and the United States

Fuel	Reserves [1]				Percent—				Reserve ratio			
	Texas		United States		Texas of United States		Change from 1961		Texas		United States	
	1961	1962	1961	1962	1961	1962	Texas	United States	1961	1962	1961	1962
Crude oil	14,850	14,648	31,759	31,389	46.7	46.7	−1.4	−1.2	15.8	15.6	12.1	11.7
Natural gas	21,400	21,365	47,808	48,887	44.8	43.7	−0.2	+2.3	20.1	19.6	20.2	19.7
Natural gas liquids	2,738	2,793	5,141	5,330	53.3	52.4	+2.0	+3.7	20.0	19.5	19.5	19.6
Total oil equivalent	38,988	38,806	84,708	85,606	46.0	45.3	−0.5	+1.1	18.2	17.9	16.1	15.8

[1] Million barrels of oil equivalent, derived by gas and liquids factors reported in table 3.

TABLE 6.—Multiple well completions in 1962

Type	Oil		Gas		Combination	Combination		
	Zones	Wells	Zones	Wells		Oil	Gas	Wells
Dual	1,128	564	556	278	140			
Triple	339	113	105	35		38	43	27
Quadruple	72	18	4	1		22	18	10
Quintuple	5	1				1	4	1
Sextuple			6	1		5	1	1
Octuple						1	7	1

Source: The Oil and Gas Journal.

The conservation program, initiated in 1960, authorizing the Secretary of the Interior to enter into long-term contracts for the purchase of helium, was implemented in 1961 with approval of annual contracting authority of $47.5 million for the purpose and negotiation of helium purchase contracts with 4 companies to recover (conserve) more than 62 billion cubic feet of helium over a 22-year period. About 41.5 billion cubic feet of the recovered helium was to be stored underground for later use. The remaining helium would be refined to market specifications (99.995 percent). The Dumas helium plant of Phillips Petroleum Co., located 4 miles southwest of Dumas, was to process 275 million cubic feet of gas daily to recover 600 million cubic feet of helium annually. The plant was essentially completed and being tested at yearend. Sherman helium plant of Phillips Petroleum Co., located 12 miles south of Guymon, Okla., in Hansford County, was tested and ready for production at yearend. The plant had a gas-processing capacity of 200 million cubic feet per day to recover 450 million cubic feet of helium per year; the helium content of the gas averaged 0.71 percent.

Lignite.—Used as a fuel to generate electric power and as a raw material for the manufacture of activated carbon, lignite was mined by open-pit methods in Milam and Harrison Counties.

Natural Gas.—Gross natural gas production was 6,905 billion cubic feet, of which 6,080 billion cubic feet was marketed. Of the marketed gas, 2,699 billion cubic feet was consumed in Texas and the rest sent to out-of-State markets. About 76 percent of the gross gas was produced from gas wells and 24 percent from oil wells (casinghead gas). Liquid fuels were extracted from over 77 percent of the gas.

Among 14,736 wells drilled, 1,544 were completed as gas wells. Development drilling added 2,771 billion cubic feet or 49 percent to natural gas reserves. Exploratory drilling added 2,845 billion cubic feet to reserves through new discoveries. Recoverable gas reserves were estimated at 119,503 billion cubic feet of natural gas on December 31, 1962, according to the Committee on Gas Reserves of the American Gas Association (AGA). This amounted to 19.6 cubic feet of gas reserve for each cubic foot produced. Almost 51 percent of the new gas reserve resulted from exploratory wells compared with 50 percent in 1961.

Oversupply began to affect Texas gas producers. State gas production advanced an average annual rate of 11 percent in the 1940–50 period, and an average 7 percent in the 1950–60 period. Domestic

TABLE 7.—Production and value of mineral fuels

Year	Crude petroleum		Natural gas[2]	
	Thousand barrels	Value (thousands)	Million cubic feet	Value (thousands)
1953–57 (average)	1,045,682	$3,001,013	4,764,258	$406,716
1958	940,166	2,872,389	5,178,073	517,807
1959	971,978	2,893,146	5,718,993	617,651
1960	927,479	2,748,735	5,892,704	665,876
1961	939,191	2,791,377	5,963,605	733,523
1962	[1] 936,508	[1] 2,796,136	6,080,210	747,866

Year	Natural gas liquids					
	Natural gasoline and cycle products		LP gas		Total	
	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)
1953–57 (average)	2,875,854	$205,069	3,354,996	$121,564	6,230,850	$326,633
1958	2,871,589	204,501	3,786,575	151,896	6,658,164	356,397
1959	2,790,155	209,238	4,353,368	181,148	7,143,523	390,386
1960	2,880,906	207,583	4,476,142	200,478	7,357,048	408,061
1961	3,111,427	214,279	4,768,222	185,558	7,879,649	399,837
1962[1]	3,205,517	233,345	5,012,291	189,382	8,217,808	422,727

[1] Preliminary figure.
[2] Marketed production, gas either sold or consumed by producers including losses in transmission, amounts added to storage, and increases in gas pipelines.

output rose nearly 8 percent per year in both periods. In 1961, Texas gas output increased 1 percent; in 1962, it increased 2 percent. There were large quantities of shut-in gas in the State, and significant volumes of casinghead gas were being used as plant fuel and/or sold at depressed prices. This surplus supply situation resulted in a new innovation in the gas industry—contracting or selling the gas reserves in place. Humble Oil & Refining Co. asked Federal Power Commission (FPC) approval to sell 6.2 trillion cubic feet of its south Texas reserves to Columbia Gas System, Inc. FPC approval would remove Columbia Gas, the largest U.S. gas purchaser, from the gas market for a period of years.

A $1 million plant to produce 35 tons of liquid oxygen, nitrogen, and argon per year was being built at Odessa by Western Oxygen, Inc., a division of American Cryogenics.

A 9-billion-cubic-foot gas reservoir in South Pottsville field, Hamilton County, was planned by Lone Star Gas Co. The new storage would add to the company's 79 billion cubic feet of gas storage in Texas and provide ample annual gas supply.

Natural Gas Liquids.—Recovery of natural gas liquids advanced 4 percent to 8,218 million gallons as demand by petrochemical, motor fuel, and industrial markets increased. LP gases supplied 61 percent of the output and natural gasoline and cycle products, the remainder. Most of the natural gasoline was utilized by the refining industry within Texas, but the major portion of the LP gases was shipped to markets outside the State. Production was reported from 353 gasoline plants, 13 of which were new installations and 32 were cycling plants. These plants were located in 92 counties. On Janu-

ary 1, there were 262 natural gas processing plants, 250 of which were operating, according to the Bureau of Mines. These included 192 absorption plants, 19 combustion plants, 14 refrigeration and absorption plants, 7 compression plants, and 30 cycling plants.

Exploratory and development drilling increased the natural gas liquid reserve to 3,829 million barrels, according to the AGA Committee on Natural Gas Liquid Reserves. This was 52 percent of domestic reserves. Development drilling added 236.6 million barrels or nearly 74 percent through extensions and revisions, and exploratory drilling added 84.2 million barrels through new discoveries.

The natural gas industry of Texas added 13 new plants in 1962, with combined gas processing capacity of 195 million cubic feet per day. Shell Oil Co. was building a 1.5-million-cubic-foot-per-day gasoline plant in the Conley field east of Quanah in Hardeman County, a 15-million-cubic-foot-per-day gas sweetener and an 11-ton-per-day sulfur unit in Karnes County, a 20-million-cubic-foot-per-day plant near McCamey in Upton County; expanded liquid recovery by 54,000 gallons daily at its Bryans Mill cycling plant in Cass County; and planned a 25-million-cubic-foot-per-day processing plant in Crockett County. Pan American Petroleum Corp. was building a 31-million-cubic-foot-per-day processing plant and a 72-long ton sulfur recovery unit in the West Yantis field in Wood County and a 11.5-million-cubic-foot-per-day gasoline plant in the La Sal Vieja field of Willacy County; it expanded its Midland Farms gasoline plant capacity from 16 to 30 million cubic feet per day. Other new plant installations during 1962 included a 6-million-cubic-foot-per-day gas processing plant of Perry R. Bass Co. in Winkler County; a 15-million-cubic-foot-per-day processing plant of Missouri River Corp. in Refugio County; a 40-million-cubic-foot-per-day separation plant of Tidewater Oil Co. in Bee County; a 30-million-cubic-foot-per-day gasoline plant of Hunt Oil Co. in Anderson County; a 6-million-cubic-foot-per-day gasoline plant of Pure Oil Co. in Andrews County; a 3-million-cubic-foot-per-day gasoline plant of Clark Fuel Producing Co. in Starr County; and an 11-million-cubic-foot-per-day sour gas processing plant of Paul C. Teas in Hunt County. Atlantic Refining Co. doubled its Block 31 gasoline plant capacity from 44 to 95 million cubic feet per day; the plant was in Crane County. The Turkey Creek plant capacity of Amarillo Oil Co. was raised from 100 to 200 million cubic feet per day.

A major gas pipeline company, Texas Eastern Transmission Corp., became a marketer of natural gas liquids by purchasing Pyrofax Gas Co., a division of Union Carbide Corp. Pyrofax was one of the nation's largest retailers of LP gases, selling more than 100 million gallons of propane to more than 500,000 customers in Canada, Bermuda, and 28 States in the Northeast, Southeast, and Upper Midwest.

Petroleum.—All phases of the State's petroleum industry—exploration and drilling, production, refining, and marketing—were influenced by national and international trends. Texas produced 35 percent of the domestic petroleum production, far more than State requirements. Over 27 percent of the U.S. refining capacity was in Texas, and less than 5 percent of the national capacity would satisfy State demands for gasoline and other petroleum products. Pipelines

carried a significant part of the crude oil and refinery products to markets outside the State. Federal regulation of oil imports and State agency regulation of crude oil production to match estimated demand continued to influence industry performance. Finally, the Texas oil producer remained his own competitor for domestic fuels markets through production and marketing of casinghead gas and condensate from oil wells.

TABLE 8.—Crude petroleum production, indicated demand, and stocks in 1962, by months

(Thousand barrels)

Month	Production	Indicated demand	Stocks originating in Texas	Month	Production	Indicated demand	Stocks originating in Texas
January	82,172	85,149	103,646	September	76,605	73,717	104,556
February	75,066	76,481	102,231	October	77,997	75,155	107,398
March	79,785	76,118	105,898	November	76,806	75,875	108,329
April	77,873	77,197	106,574	December	78,023	79,308	107,044
May	78,630	78,619	106,585				
June	76,861	78,589	104,857	Total:			
July	78,634	80,525	102,966	1962 [1]	936,508	936,087	----------
August	78,056	79,354	101,668	1961	939,191	933,181	----------

[1] Preliminary figures.

TABLE 9.—Volume of crude petroleum and natural gas by counties [1]

County	Crude oil (thousand barrels)		Natural gas (million cubic feet)		County	Crude oil (thousand barrels)		Natural gas (million cubic feet)	
	1961	1962	1961	1962		1961	1962	1961	1962
Anderson	6,500	6,483	23,075	23,765	Cottle	3	3	----------	----------
Andrews	64,330	65,702	113,817	115,572	Crane	36,970	39,276	37,912	45,441
Angelina	11	10	375	415	Crockett	7,336	6,914	16,429	15,503
Aransas	2,063	1,581	26,838	31,232	Crosby	158	137	----------	----------
Archer	8,944	9,097	4,362	4,389	Culberson	1,204	1,180	590	920
Atascosa	2,865	2,703	47,494	44,139	Dallam	----------	----------	1,094	1,132
Austin	1,560	1,598	10,330	9,125	Dawson	5,281	6,459	1,716	1,727
Bastrop	98	91	34	34	Denton	74	72	856	1,526
Baylor	2,821	2,431	25	25	DeWitt	1,616	1,580	29,589	29,820
Bee	1,245	1,276	60,423	61,645	Dickens	39	38	64	64
Bexar	321	310	----------	----------	Dimmit	430	320	261	330
Borden	9,824	8,343	(2)	(2)	Donley	----------	----------	134	135
Bowie	3	(3)	139	91	Duval	10,183	9,683	41,364	35,963
Brazoria	17,292	16,330	328,107	352,024	Eastland	639	636	7,592	5,130
Brazos	----------	----------	837	923	Ector	60,604	56,769	90,248	79,889
Brooks	2,557	2,864	69,484	91,340	Edwards	1	1	----------	----------
Brown	422	331	1,222	1,762	Erath	14	15	7,727	9,980
Burleson	1	2	----------	----------	Falls	13	11	8	8
Caldwell	2,672	3,154	1	1	Fayette	192	211	36	47
Calhoun	1,945	1,950	87,297	103,957	Fisher	3,864	4,133	5,822	5,148
Callahan	2,225	2,271	526	2,906	Floyd	2	1	----------	----------
Cameron	7	7	1,777	3,649	Foard	926	992	157	203
Camp	376	482	3	3	Fort Bend	7,939	7,598	18,776	17,602
Carson	4,273	4,158	103,265	106,102	Franklin	3,363	2,527	16,216	3,605
Cass	1,837	1,599	6,914	12,670	Freestone	582	580	8,712	9,376
Chambers	12,517	12,624	93,530	88,187	Frio	1,292	1,130	9,516	8,938
Cherokee	1,573	1,304	(2)	(2)	Gaines	28,542	28,809	17,500	20,862
Childress	45	161	147	547	Galveston	10,374	11,755	42,142	39,095
Clay	4,490	4,074	528	550	Garza	6,017	5,699	381	384
Cochran	8,284	7,875	12,889	12,980	Glasscock	1,508	1,623	3,053	3,071
Coke	6,202	5,917	44,549	44,773	Goliad	1,410	1,441	38,568	38,107
Coleman	3,169	2,690	15,160	13,221	Gonzales	36	88	36	5
Collingsworth	(3)	----------	9,216	6,901	Gray	12,382	11,522	95,862	92,991
Colorado	741	722	80,255	56,914	Grayson	6,172	7,440	9,015	6,880
Comanche	57	46	482	533	Gregg	29,077	28,276	38,563	32,872
Concho	122	293	323	378	Grimes	(3)	----------	326	333
Cooke	9,547	9,307	2,097	2,104	Guadalupe	4,404	3,997	18	22

See footnotes at end of table.

TABLE 9.—Volume of crude petroleum and natural gas by counties[1]—Continued

County	Crude oil (thousand barrels)		Natural gas (million cubic feet)	
	1961	1962	1961	1962
Hale	1,352	453	191	192
Hamilton			558	459
Hansford	2,413	2,701	66,748	71,886
Haderman	610	1,008		
Hardin	6,383	6,800	38,120	38,289
Harris	18,545	20,814	51,014	50,162
Harrison	2,721	2,471	71,873	74,477
Hartley	47	34	17,440	16,089
Haskell	4,306	4,359	524	4,882
Hemphill	97	109	1,557	1,756
Henderson	496	2,889	21,843	22,132
Hidalgo	639	556	209,996	210,605
Hill	1	1	1	1
Hockley	7,938	8,184	14,743	14,840
Hopkins	1,087	1,026	14,171	14,379
Houston	460	922	4,387	8,599
Howard	12,666	12,723	2,225	2,238
Hunt	7	6		930
Hutchinson	12,188	11,263	94,844	93,673
Irion	699	577	1,471	2,007
Jack	4,822	5,443	18,119	15,177
Jackson	10,093	9,965	94,109	97,588
Jasper	537	478	5,502	7,766
Jefferson	7,749	8,920	108,904	120,287
Jim Hogg	4,016	3,964	24,874	45,007
Jim Wells	11,481	11,276	116,162	108,115
Johnson			5	5
Jones	5,337	5,464	2,121	6,118
Karnes	3,201	3,282	13,894	14,623
Kaufman	496	443	(2)	(2)
Kenedy	272	563	17,188	17,498
Kent	8,767	8,632	2,670	2,686
Kimble	1	1	56	68
King	1,069	1,009	241	584
Kleberg	7,181	9,835	143,320	160,615
Knox	2,615	2,281	140	141
Lamb	930	1,682	64	64
La Salle	303	277	4,670	4,466
Lavaca	171	106	40,520	43,358
Lee	30	21	17	15
Leon	352	821	18,701	14,203
Liberty	10,996	7,834	31,077	31,860
Limestone	328	285	4,924	8,913
Lipscomb	383	1,077	3,635	6,318
Live Oak	1,636	1,625	65,839	70,891
Loving	3,480	3,709	2,579	2,596
Lubbock	389	351	(2)	(2)
Lynn	502	565	64	64
Madison	163	303	6,517	6,844
Marion	1,168	1,030	21,171	17,928
Martin	2,091	2,377	127	128
Matagorda	6,730	6,905	157,114	178,631
Maverick	1,026	793	125	93
McCulloch	7	2		202
McLennan	4	5	4	4
McMullen	1,102	1,085	47,356	51,507
Medina	309	434	(2)	(2)
Menard	109	119	35	36
Midland	13,422	14,102	99,327	95,124
Milam	80	86		
Mitchell	2,423	2,321	509	512
Montague	5,763	5,754	10,820	11,249
Montgomery	6,448	6,174	37,326	36,530
Moore	400	444	227,807	227,740
Motley	376	370		
Nacogdoches	1	2	24,024	24,291
Navarro	2,062	2,232	639	475
Newton	1,457	1,932	7,567	7,323
Nolan	5,139	5,162	14,420	6,784
Nueces	8,568	9,062	244,766	246,848
Ochiltree	4,379	4,256	52,852	57,515
Oldham	6	1	21	3
Orange	1,957	1,917	37,909	38,117
Palo Pinto	296	257	5,970	7,834
Panola	2,476	3,607	225,231	196,193
Parker	16	17	4,228	4,558
Pecos	13,873	12,819	140,989	168,746
Polk	1,438	1,359	4,224	4,022
Potter			70,320	68,917
Rains			1	15
Reagan	4,873	4,333	29,854	29,568
Red River	39	30	24	24
Reeves	1,814	1,943	9,821	11,075
Refugio	15,726	16,780	135,532	150,176
Roberts	1,259	1,203	13,693	14,784
Robertson	17	15	11	11
Runnels	4,722	4,381	11,376	11,147
Rusk	18,931	17,577	29,569	36,732
San Augustine		1	1	1
San Jacinto	350	340	5,156	4,825
San Patricio	11,774	10,355	85,546	89,059
Schleicher	2,817	2,814	14,679	16,297
Scurry	31,148	29,784	13,032	13,110
Shackelford	3,542	3,379	3,527	5,659
Shelby	12	8	9,783	9,686
Sherman	18	11	149,755	144,784
Smith	3,400	2,748	12,408	10,332
Starr	5,170	5,296	72,275	82,346
Stephens	2,476	2,182	10,152	8,867
Sterling	646	820	5,276	5,308
Stonewall	6,022	5,535	4,922	6,198
Sutton	5	5	5,377	4,833
Taylor	5,009	4,372	3,824	4,962
Terrell			26,242	26,744
Terry	5,473	5,333	1,907	1,919
Throckmorton	2,916	2,760	510	3,157
Titus	4,665	4,760	16	16
Tom Green	1,881	1,944	2,632	2,726
Travis	20	23		
Tyler	662	640	3,806	3,939
Upshur	2,107	1,774	1,292	1,300
Upton	11,609	11,801	41,822	41,597
Uvalde			(4)	(4)
Val Verde	2	1	6,044	4,977
Van Zandt	5,100	4,904	202	2,016
Victoria	3,707	4,584	95,620	83,025
Walker	5	5		
Waller	535	624	153,693	155,154
Ward	21,042	22,145	14,753	14,997
Washington	194	177	32	35
Webb	1,956	2,026	8,585	9,370
Wharton	4,404	4,338	70,972	78,767
Wheeler	1,721	1,661	14,983	14,577
Wichita	11,030	10,563	7,790	7,836
Wilbarger	6,304	6,265	896	901
Willacy	1,682	1,703	13,589	12,761
Williamson	38	38		
Wilson	435	546	13	7
Winkler	25,848	25,238	293,669	266,367
Wise	3,356	3,307	63,291	71,651
Wood	15,492	14,327	9,138	16,428
Yoakum	13,961	13,965	18,380	18,558
Young	5,779	5,700	4,534	4,894
Zapata	693	625	11,287	17,846
Zavala	189	385	2,896	2,796
Undistributed	8		11,114	11,098
Total	939,191	936,508	5,963,605	6,080,210

[1] Represents crude petroleum production and marketed natural gas.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Less than 500 barrels.
[4] Less than 500 cubic feet.

Texas crude oil production which has declined irregularly since the record output of 1,107.8 million barrels in 1956, was 936.5 million barrels in 1962. Production was reported from 198 counties, 1 less than in 1961. There were 122 counties reporting production in excess of 1 million barrels each. The 10 leading crude oil producing counties in declining order were: Andrews, Ector, Crane, Scurry, Gaines, Gregg, Winkler, Ward, Harris, and Rusk.

In 1962, the State oil and gas industry drilled 14,736 wells in search of crude oil and natural gas, nearly 1 percent under those drilled in 1961, according to the Oil & Gas Journal. Among these wells, 3,124 were wildcats of which 391 were completed as oil wells, 279 as gas wells, and 2,454 were dry holes. Of 11,612 development wells drilled, 7,543 were oil wells, 1,265 were gas wells, 439 service wells, and 2,365 were dry holes. Only 21 percent of the Texas wells completed in 1962 were wildcat wells. The success ratio of wildcat drilling was one discovery—oil or gas—for every five wells drilled. Estimated proved recoverable reserves of crude oil declined 1 percent to 14,648.3 million barrels as of December 31, according to the Committee on Crude Oil Reserves of the American Petroleum Institute. Extensions and revisions added 592.5 million barrels to proved reserves and new discoveries added 99.9 million barrels.

TABLE 10.—Petroleum daily average production and runs to stills

(Thousand barrels)

Month	1961		1962	
	Crude production	Runs to stills	Crude production	Runs to stills
January	2,593	2,278	2,651	2,287
February	2,625	2,343	2,681	2,324
March	2,807	2,240	2,574	2,188
April	2,680	2,194	2,596	2,262
May	2,518	2,209	2,536	2,314
June	2,511	2,094	2,562	2,352
July	2,468	2,206	2,537	2,293
August	2,520	2,276	2,518	2,381
September	2,460	1,916	2,554	2,237
October	2,500	2,224	2,516	2,276
November	2,522	2,163	2,560	2,298
December	2,638	2,124	2,517	2,335

Texas had 60 refineries, 55 of which operated in 1962 to process 838 million barrels of crude oil, 75 percent of which was Texas production. Refinery capacity at yearend was 2.7 million barrels of crude oil daily, 27 percent of the U.S. capacity. About 85 percent of this capacity was on the Gulf Coast, in the Beaumont-Port Arthur-Houston areas. Jefferson County had nearly 85 percent of the Gulf Coast capacity. The concentration of refinery capacity was in part the result of excellent port and deep water facilities for import from and export to foreign or domestic products markets.

No new refineries were added in 1962. Significant internal changes in capacities and units, however, were made at 10 Gulf Coast refineries and 8 inland refineries to reduce crude capacity by increasing products outputs and/or to improve plant efficiencies. Capacity increases were made in vacuum distillation, fluid catalytic cracking,

and recycle cracking at the Wichita Falls refinery of American Petrofina Co. The company also increased asphalt capacity at its Mount Pleasant refinery.

TABLE 11.—Runs to stills and output of refineries in 1962, by months

(Thousand barrels)

Month	Runs			Output					
	Crude	Products	Rerun	Gasoline	Kerosine	Fuel oil		Jet fuel	Miscellaneous
						Distillate	Residual		
January	70,886	6,948	−3,683	36,431	5,091	19,026	3,760	1,992	7,851
February	65,058	6,349	−224	34,287	5,006	18,086	3,994	2,124	7,686
March	67,834	6,958	−99	37,607	4,242	18,245	3,701	2,651	8,445
April	67,868	6,276	−2,947	37,077	3,424	15,754	3,741	2,448	8,753
May	71,731	7,469	−1,759	40,206	3,820	17,942	3,517	2,604	9,352
June	70,554	7,386	−2,348	39,508	3,824	17,394	3,350	2,564	8,952
July	71,071	7,537	−747	40,376	4,820	17,496	3,393	2,294	9,482
August	73,809	7,843	−3,130	40,022	4,190	18,656	3,443	3,155	9,056
September	67,121	7,965	−740	38,482	4,086	16,817	3,521	2,838	8,602
October	70,561	8,313	−1,343	40,218	4,399	17,653	2,786	3,240	9,235
November	68,950	7,822	−1,863	38,161	4,561	16,901	3,287	3,567	8,432
December	72,377	7,640	−2,132	38,702	5,495	18,676	3,967	2,553	8,492
Total:									
1962	837,820	88,506	−21,015	461,077	52,958	212,646	42,460	32,030	104,338
1961	798,914	77,912	−20,789	430,827	47,780	198,680	53,250	27,637	97,863

TABLE 12.—Stocks of crude petroleum at refineries, tank farms, and gathering systems in 1962, by months

(Thousand barrels)

Month	Refineries	Tank farms and pipelines	Lease tanks	Total
January	15,723	67,636	8,054	91,413
February	16,270	67,754	7,989	92,013
March	17,242	70,015	7,864	95,121
April	16,872	73,328	7,914	98,114
May	16,640	71,941	7,879	96,460
June	16,424	69,722	7,834	93,980
July	16,642	67,029	7,809	91,480
August	15,945	66,476	7,639	90,060
September	16,919	68,384	7,794	93,097
October	16,126	71,157	7,589	94,872
November	16,591	72,974	7,584	97,149
December	15,452	71,156	7,689	94,297

Some of the more important changes in refineries were as follows: Atlantic Refining Co. added capacities to its fluid cracking, unifining, sulfuric acid (H_2SO_4) alkylation units and reduced recycle cracking and catalytic forming at its Port Arthur refinery; El Paso Natural Gas Co. increased fluid catalytic cracking at its Odessa plant; California Oil Co. raised the H_2SO_4 alkylation capacity at its El Paso plant; vacuum distillation, delayed coking, recycle, and lube capacity were increased at the Beaumont refinery of Mobil Oil Co.; vacuum distillation and fluid catalytic cracking capacities were raised at the Corpus Christi refinery of Pontiac Refining Co.; crude oil capacity and asphalt production were increased by Pure Oil Co. at its Nederland plant; crude oil capacity of the Sunray refinery

was increased by Shamrock Oil & Gas Co.; Shell Oil Co. added to the crude oil capacity, fluid cracking capacity, and middle distillate capacity at the Houston refinery; and Sinclair Refining Co. raised crude, reforming, and hydrogen treatment capacities at its Houston facility.

TABLE 13.—Stocks of refined products by refineries with plants and pipelines in 1962, by months

(Thousand barrels)

Month	Gasoline [1]	Kerosine	Fuel oil		Jet fuel	Natural gas liquids	Miscellaneous products
			Distillate	Residual			
January	30,222	2,746	12,185	6,969	2,042	907	29,866
February	33,649	3,230	11,392	7,103	2,186	1,004	29,623
March	32,885	3,520	11,710	5,683	2,262	938	28,844
April	32,212	3,440	11,544	6,153	2,380	1,192	30,145
May	30,430	3,798	14,651	5,800	2,407	1,420	29,884
June	30,910	4,208	16,431	6,240	2,209	1,340	30,994
July	29,260	4,756	17,604	6,705	2,066	1,232	29,763
August	29,897	4,822	21,202	7,065	2,375	957	30,394
September	28,670	4,964	22,784	7,755	2,141	1,111	29,449
October	29,053	4,603	24,656	6,758	2,479	1,169	29,095
November	30,730	4,396	23,144	5,781	2,955	1,200	30,225
December	34,347	4,296	18,717	6,558	2,760	1,264	30,889

[1] Includes naphtha.

Petrochemicals.—Major advances in facilities and new plants were made in the petrochemical industry. There was little change in composition of the industry's corporate structure, expansions being equally divided between oil and gas companies and chemical companies. Capacities of select basic feedstocks—ethylene, propylene, acetylene, naphthalene, and benzene—were increased, as were capacities of certain intermediates and derivatives—butadiene, styrene, and ammonia. The most spectacular advances were made in facilities producing ethylene and ammonia. Although volume changes were greatest in ethylene facilities, advances made in ammonia capacities were of immediate interest. The domestic fertilizer industry has grown rapidly during the past 5 years, creating enlarged demands for basic ingredients—nitrogen, potash, and phosphates. The potash and phosphate industries have been able to meet these increased demands from existing mineral deposits. However, the nitrogen and hydrogen constituents of ammonia were dependent upon chemical plants for recovery. Consequently, the number and capacities of ammonia plants have been increasing in Texas since 1960 and extensive growth occurred in 1962. New additions to the State's ammonia production were a 600-ton-per-day unit at the Texas City refinery of American Oil Co. and a 225-ton-per-day ammonia unit added to the Victoria chemical facilities of Du Pont. These ammonia plants were resource oriented to natural gas suppliers instead of market oriented.

Other expansions in the Texas petrochemical industry included the giant complex of Monsanto Chemical Co. at Chocolate Bayou, south of Houston, in Brazoria County. The plant had facilities to produce 500 million pounds of ethylene, 55 million gallons of benzene, 85 million pounds of naphthalene, and 50 million pounds of phenol per

year. The company added 45 million pounds per year of vinyl acetate capacity to its Texas City plant and planned a 50-million-pound-per-year linear polyolefin unit and a 10-million-pound-per-year synthetic lactic acid facility. Diamond Alkali Co. was expanding the vinyl chloride monomer capacity of its Houston plant from 75 to 100 million pounds per year. Annual propylene capacity of the Baytown chemical plant of Enjay Chemical Co., Division of Humble Oil & Refining Co., was raised from 40 to 75 million pounds. Its ethyl benzene capacity would also be increased. The company planned a $6 million plant to produce basic alcohols, other oxo chemicals, and to expand butyl rubber capacity. At the Orange, Tex., chemical complex, Du Pont was building a low-density polyethylene unit and planned a facility to produce vinyl resins. Firestone Synthetic Rubber & Latex Co. added a butadiene unit and was modernizing and expanding other facilities. Suntide Refining Co. completed a new 60-million-pound-per-year styrene unit at its Corpus Christi refinery. National Petro Chemical Corp. built a new polyethylene plant in Houston. Mobil Chemical Co., subsidiary of Socony Mobil Oil Co., completed a 20-million-pound-per-year high-purity benzene and toluene unit adjacent to the Mobil Oil Beaumont refinery. Rexall Drug & Chemical Co. and El Paso Natural Gas Products Co. planned a $10 million polypropylene addition to their Odessa chemical complex. Gulf Oil Corp. was building a 400-million-pound-per-year ethylene unit and planned a 100-million-pound-per-year propylene unit of a chemical complex at Cedar Bayou near Baytown. The company was expanding the cyclohexane capacity of its Port Arthur plant by 50 percent.

NONMETALS

During the year, interest was shown in the nonmetal sector of the mineral economy. This was reflected by expanding markets for nonmetallic minerals produced in Texas, and by consideration of latent mineral deposits within the State. There was a realization that to broaden the industrial phase of the State economy, it would be necessary to develop further the nonmetallic sector of the mineral industry. As the Texas economy grows industrially, in population, and in personal income, there was expected to be an increasingly strong demand for all types of minerals.

Construction activity totaled an estimated $1.5 billion, an increase of 12 percent over the alltime high established in 1961. Residential construction represented approximately 53 percent of the total dollar volume. Nonresidential construction comprised 37 percent of the total volume. Over 85 percent of this construction occurred in metropolitan areas.

Texas Highway Department continued to construct major and minor highways. Plans and programs were formulated that would provide for an estimated expenditure of $495 million to build 10,172 miles of highway. The production of nonmetallic minerals, especially of construction materials, was expected to benefit in two ways. Highway construction has required and would continue to require an important part of the total supply of cement, sand and gravel, lime,

stone, and asphalt. Construction of new highways would also afford many parts of the mineral industry the means for transporting their products to the market.

Barite.—Continental Minerals plant in Culberson County, 6 miles east of Van Horn, was improved. The company produced crude barite for use in drilling muds. The low level of drilling activity in the State reduced the consumption of barite for this purpose. Barite from other States and from foreign countries was ground and prepared in plants at Brownville, Carthage, Corpus Christi, and Houston.

Bromine.—Texas ranked second in bromine output. Ethyl Dow Chemical Co. was the State's leading producer. Most of the bromine was produced as ethylene dibromide and used as an additive in antiknock compounds for motor fuels.

Cement.—Continuing the trend of recent years, the cement industry increased its production capacity by 2.4 million barrels to a total of 41.2 million barrels. Since 1957, 9 million barrels of additional capacity has been constructed. The results of this increased capacity have been lower prices, redefinition of individual plant market areas, and reduced use of total capacity (64 percent in 1962). Fourteen of the 17 plants produced masonry as well as portland cement. The industry quarried 4.6 million tons of limestone and recovered or purchased 2.5 million tons of shell to ship a total of 27.1 million barrels of cement.

Perhaps the most important development besides overexpansion of capacity was in transportation and storage. Truck transportation of cement using an air entrained system was radically extending the marketing radius. In addition, the industry was developing a policy of building cement supply depots in important metropolitan areas and shipping from existing plants. Some cement plants have been affected by rapid metropolitan expansion; in many instances, this has hampered the quarrying of limestone for use as a raw materal.

TABLE 14.—Portland cement production, shipment, and consumption

(Thousand barrels and thousand dollars)

Year	Production (barrels)	Shipments		Consumption		
		Quantity	Value	Barrels	Percent change	
					Texas	United States
1953–57 (average)	22,507	22,378	$61,853	19,196	----------	----------
1958	25,465	25,209	77,186	22,323	+18	+6
1959	27,111	27,215	85,022	23,884	+7	+9
1960	23,190	22,721	73,964	20,195	−15	−7
1961	24,889	25,101	80,808	21,566	+7	+3
1962	26,443	26,204	83,162	22,900	+6	+3

Alpha Portland Cement Co. acquired the Texas Portland Cement Co. plant at Echo, Texas, for $4.3 million. Plans were made to double the present capacity of 800,000 barrels. Gulf Coast Portland Cement Co. completed its 1.4-million-barrel-capacity plant at Houston. Shell from shallow bays of the Gulf of Mexico, clay deposits of

the Pleistocene Beaumont clay, and east Texas iron ore were used in the manufacture of the cement at this plant. Southwestern Portland Cement Co. began constructing an $8 to $10 million cement plant at Bushland, 14 miles west of Amarillo. In a relatively new process, this plant was using impure caliche occurring in the late Cenozoic sand deposits near Bushland. These deposits will supply the calcium carbonate, alumina, silica, and some of the iron oxide needed to prepare cement. Texas Industries, Inc., began expanding its Midlothian plant to produce 2.8 million barrels of portland cement, doubling existing output. Halliburton Co. started operating its bulk cement plant at Midway with an initial capacity of 10,000 to 12,000 sacks of cement per month for use as a blend to specific oil-well cementing requirements. Southwestern Portland Cement Co. in El Paso expanded its manufacturing facilities at an estimated cost of $25,000 to produce 18,000 sacks of portland cement per day.

Clays.—Markets for the multicolored brick produced from Texas clays were as far north as Canada. Production was reported from 47 counties by 70 producers and 15 portland cement companies. Miscellaneous clay accounted for 80 percent of the total clay production, but for only 57 percent of the total value; 45 percent of this clay was used in the manufacture of cement, 31 percent in heavy clay products, and 24 percent was for lighweight aggregate. Sixteen percent of the total clay production was fire clay, accounting for 28 percent of the total value. Bentonite accounted for the remaining 4 percent of output and 15 percent of value. Fuller's earth was produced in Fayette County. Use of clay and shale in the manufacture of lightweight aggregate has increased steadily during the past 8 years from 273,000 tons in 1954 to 750,000 tons in 1962. Waco Aggregate Co. in Waco began producing in 1962, using a blue shale as the basic raw material. The new plant operated two 8- by 120-foot gas-fired kilns, and total capacity was 250 tons per day. Hereford Tile & Brick Co. expanded and modernized its plant to an increased capacity of 100,000 units a week.

TABLE 15.—Clays sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Bentonite		Fire clay		Miscellaneous clay		Total[1]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	119	$1,115	416	$1,247	2,233	$2,560	2,768	$4,922
1958	121	889	501	1,135	3,097	3,400	3,719	5,424
1959	133	947	722	1,596	3,015	3,160	3,870	5,703
1960	116	873	715	1,668	2,471	2,517	3,302	5,058
1961	122	900	676	1,660	2,988	3,177	3,786	5,737
1962	118	873	615	1,558	3,011	3,203	3,744	5,634

[1] Incomplete total, excludes fuller's earth.

Fluorspar.—Framspar, Inc., announced plans to construct a $500,000 fluorspar flotation mill at Alpine. The ore would be imported from company-owned mines in Mexico.

Graphite.—Southwestern Graphite Co. was the only domestic producer. Graphite was mined from an open pit and processed at an adjacent mill in Burnet County. The company continued a small exploration program and planned some moderate changes in quarry operations to facilitate mining and transportation of the ore to the mill. The Joseph Dixon-Crucible Co. of New Jersey acquired control of the graphite company.

Gypsum.—Mining and milling of gypsum deposits occurred at seven operations in five counties. About 48 percent of the output was calcined. Building products consisting of wallboard, lath, exterior sheathing, and plaster consumed most of the output. Some uncalcined gypsum was sold to cement producers for use as a retarder.

TABLE 16.—Crude gypsum mined

Year	Short tons	Value	Year	Short tons	Value
1953–57 (average)	1,167,106	$3,563,947	1960	1,131,034	$3,960,361
1958	1,240,050	4,120,311	1961	1,073,671	[1] 3,832,000
1959	1,351,060	4,770,228	1962	1,119,955	3,955,889

[1] Revised figure.

Lime.—High-calcium lime was produced from limestone and shell by 12 producers in 10 counties. The record tonnage of lime required 942,000 tons of limestone and 844,000 tons of shell. The 1,047,000 tons of lime produced in Texas does not include regenerated lime. About 25 percent of the lime produced was used by the construction industry, and 75 percent was required for chemical and industrial uses. The Texas Highway Department used lime in soil stabilization of highways.

TABLE 17.—Lime sold or used by producers

Year	Quicklime (short tons)	Hydrated lime (short tons)	Total	
			Short tons	Value (thousands)
1953–57 (average)	355,775	243,503	599,278	$5,956
1958	414,302	276,359	690,661	7,146
1959	414,052	394,725	803,777	8,530
1960	433,405	388,037	821,442	9,087
1961	[1] 412,063	377,475	[1] 789,538	[1] 8,703
1962	585,214	461,042	1,047,256	11,999

[1] Revised figure.

Magnesium Compounds.—Magnesium compounds were produced at the Freeport plant of The Dow Chemical Co. in Brazoria County. Production increased over 400 percent because of the requirements of the E. J. Lavino and Co. basic refractories plant, which used magnesium hydroxide slurry piped from The Dow Chemical Co. plant. The slurry was processed to a dense hydration-resistant high-purity periclase grain for manufacturing basic refractories. The periclase was used in company plants in Indiana and Pennsylvania.

Natural Salines.—Natural sodium sulfate was recovered from artificial brines in Terry and Ward Counties by Ozark-Mahoning Co. Most of the output was used in preparing salt cake.

Perlite (Expanded).—Expanded perlite sold or used increased 13 percent in quantity. This material was used primarily for filter aids, concrete aggregate, building plaster, insulation, and soil conditioning. Perlite Producers, Inc., began operating its 30-ton-per-hour perlite processing plant at Marfa.

Pumice.—Pumicite was mined by open-pit methods in Starr County for use as a concrete aggregate, a concrete admixture, and a carrier for insecticides.

Salt.—Produced by 11 producers in 10 counties, salt output increased over 18 percent from that of 1961. About 94 percent of the tonnage was salt in brine. Most of the output was used as a basic raw material by the heavy chemical industry.

TABLE 18.—Salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953-57 (average)	3,574	$11,732	1960	4,756	$18,222
1958	3,843	15,114	1961	4,695	17,682
1959	4,519	17,498	1962	5,553	19,485

Sand and Gravel.—The expanding construction industry demanded quality products from producers of sand and gravel. Commercial operations provided 85 percent of the tonnage of sand and gravel produced, a 10 percent increase over that of 1961.

Stone.—Texas ranked third in stone output and quarried and prepared basalt, granite, marble, limestone, sandstone, and miscellaneous stone. Output, including shell, totaled 38 million tons, and crushed limestone amounted to 67 percent of the production.

High-calcium limestone, suitable for manufacturing lime, occurred in a few of the Lower Cretaceous limestone (particularly the Edwards formation) of Texas. The Edwards formation was utilized for making lime by United States Gypsum Co. near New Braunfels in Comal County, the Round Rock White Lime Co. at Round Rock in Williamson County, the Austin White Lime Co. at McNeil in Travis County, and the Texas Lime Co., west of Cleburne in Johnson County. The White Stone Lime Co. at Cedar Park in Williamson County used high-purity limestone from the White Stone lentil of the Walnut formation. Results of chemical tests on samples of high-calcium Lower Cretaceous limestone collected in Edwards, Kinney, Real, Uvalde, Val Verde, and McMullen Counties are included in The University of Texas, Bureau of Economic Geology Report of Investigations 42, "Mineral Resources of South Texas," 1962.

Additional studies of high-purity strata in the Lower Cretaceous limestone which crops out across Texas from the Red River to the Rio Grande were nearing completion by geologists of the Bureau of Economic Geology. Results of these investigations would be published soon.

Sulfur.—Increasing imports from Canada and Mexico vitally affected the Texas sulfur industry. In addition, there was rising competition from sulfur recovered from sour gas. Canada shipped twice as much sulfur into the United States in 1962 as in 1961, and Mexican imports increased 10 percent over those of 1961.

TABLE 19.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Quantity	Value	Quantity	Value	Quantity	Value
1953–57 (average)	20,488	$22,023	4,703	$1,338	25,191	$23,361
1958	27,015	28,703	5,856	2,105	32,871	30,808
1959	29,520	32,098	5,775	2,628	35,295	34,726
1960	26,918	29,857	2,926	897	29,844	30.754
1961	23,272	27,975	4,126	2,716	27,398	30,691
1962	25,619	29,948	4,457	3,149	30,076	33,097

TABLE 20.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	6,506	$6,478	7,396	$6,735
Paving	3,058	2,823	3,771	3,914
Fill	317	163	390	165
Other [1]	404	1,459	541	1,852
Total	10,285	10,923	12,098	12,666
Gravel:				
Building	7,631	10,478	6,517	8,764
Paving	4,722	6,066	6,487	8,220
Fill	126	105	196	70
Other [2]	508	403	321	228
Total	12,987	17,052	13,521	17,282
Total sand and gravel	23,272	27,975	25,619	29,948
Government-and-contractor operations:				
Sand:				
Building	52	46	6	8
Paving	720	394	271	118
Fill			10	4
Total	772	440	287	130
Gravel:				
Building	373	531	18	26
Paving	2,981	1,745	4,152	2,993
Total	3,354	2,276	4,170	3,019
Total sand and gravel	4,126	2,716	4,457	3,149
Grand total	27,398	30,691	30,076	33,097

[1] Includes glass, molding, engine, and other construction, industrial, and ground sand.
[2] Includes railroad ballast, miscellaneous, and other construction gravel.

Continuing the expansion of recent years, additional capacity for recovering sulfur from sour gas became available in Texas. National Sulphur Co. recovered sulfur at its new Lehman plant in Cochran County; capacity would be 9 tons of sulfur per day from an acid gas stream which previously had been vented. Trans-Jeff Chemical Corp. doubled its plant capacity at Tilden. American Petroleum Corp. announced plans to construct a $3.5 million sulfur recovery and gas processing plant at Edgewood. Pan American Petroleum Corp. planned to build a 31-million-cubic-foot-per-day gas-

oline plant in West Yantis field, Woods County, that was scheduled to be completed in the spring of 1963. Recovery of 72 tons of sulfur per day was expected. Paul C. Teas announced construction plans which included a sulfur recovery unit at a gas processing plant in Quinland field, Hunt County.

TABLE 21.—Stone sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Limestone		Sandstone		Shell		Miscellaneous		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1958	25,470	$24,794	997	$851	9,035	$12,684	404	$803	36,076	$40,912
1959	29,141	30,064	2,406	1,189	10,310	14,419	177	257	42,172	47,787
1960	26,620	26,208	1,816	1,036	10,304	15,793	159	212	39,029	45,088
1961	24,439	25,718	2,266	1,511	10,531	15,373	905	695	38,316	45,874
1962	25,717	27,851	1,266	2,045	10,073	14,701	584	499	38,067	48,988

[1] Includes other stone to avoid disclosing individual company confidential data.

TABLE 22.—Sulfur produced and shipped from Frasch mines

(Thousand long tons and thousand dollars)

Year	Production	Shipments		Year	Production	Shipments	
		Quantity	Value			Quantity	Value
1953–57 (average)	3,608	3,435	$91,355	1960	2,679	2,747	$62,855
1958	2,588	2,616	61,621	1961	2,778	2,730	62,720
1959	2,519	2,970	68,998	1962	2,622	2,655	57,297

The rising trend of shipping and storing sulfur in molten form continued. Texas Gulf Sulphur announced that they handled approximately 80 percent of their total shipments in this manner. Loss of the Marine Sulphur Queen complicated the company's transportation of sulfur to the eastern seaboard market. Texas Gulf Sulphur announced that a new and larger seagoing tanker was being outfitted on the East Coast for the sulfur run. Hearings were scheduled on requests by industry for the Texas State Legislature to reduce the severance tax on sulfur from $1.40 per ton to $1.03 per ton.

The Division of Mineral Resources of the Bureau of Mines, Bartlesville, Okla., expected to publish its Information Circular, "Sulfur Resources and Markets of the South-Central United States," in 1963.

Talc and Soapstone.—Although tonnage produced dropped 6 percent, the increased price of Texas talc raised value by 3 percent. Talc and soapstone were produced in two counties by nine operations. Texas talc was accepted in markets throughout the country, and 71 percent of the talc produced was used in the ceramics industry.

Vermiculite (Exfoliated).—Crude vermiculite from other States was expanded at four plants: Two in Harris County, one in Dallas County, and one in Burnet County. Principal uses were in concrete, plaster, and loosefill insulation.

Water.—Development of the State's water resources was continued by Federal, State, and local governments. The U.S. Army Corps of Engineers activated several river basin studies for examining the feasibility of constructing multipurpose facilities in the State.

The U.S. Army Corps of Engineers recommended that Congress authorize a $32.8 million project deepening of the Gulf Intercoastal Waterway in Louisiana and Texas. The Corps recommended a 16-foot deep channel from the Mississippi River to the Houston Ship Channel and a 12-foot-deep channel through Matagorda Bay, Corpus Christi Bay, between Aransas Bay and Aransas Pass. The executive Committee of the Joint Louisiana-Texas River Authority for the Toledo Bend Dam indicated that it would recommend a 20-foot-deep channel from the dam to Logan Port, about 100 river miles. The Bureau of Reclamation reported that the Canadian River Dam was 35 percent complete.

Early in 1963, the Bureau of Mines would begin a canvass of the water used by the State's mineral industry in 1962. The data would be used in a nationwide study of water resources.

The saline water conversion plant at Freeport continued analyses of equipment, method, and cost of converting sea water to potable water.

METALS

Metal mining was not a major factor in the Texas mineral economy. Individually, two of the three metals produced in 1962—iron ore and magnesium—were important in their own metal field. Uranium, the third metal, depended upon the Government purchase program of refined "yellow cake." Apropos of this limited industry, the State's metals extractive and fabricating industry consisted of a large number of metallurgical plants which processed ores or other materials received from other States and from foreign countries. Also, it included numerous plants which fabricated these metals into various shapes and products. These metal industries contributed substantially to State payrolls, capital expenditures, and investments; to power and service requirements; and to local and State taxes. Metals produced at these extractive metallurgical plants included aluminum from imported bauxite ores; antimony, manganese, and tin from foreign ores and concentrates; and cadmium, copper, lead, silver, and zinc from domestic and foreign ores. All these metals except iron were dependent upon markets outside of Texas.

Aluminum.—Improved market demands for aluminum resulted in expanded output at the three aluminum reduction plants—the Point Comfort and Rockdale works of Aluminum Company of America (Alcoa) and at the San Patricio works of Reynolds Metals Co. Alcoa installed a new $500,000 casting unit for direct chill ingots at its Rockdale works. The company was also adding to dock facilities and deepening the turning basin and slip to the Matagorda Channel at Port Lavaca. The U.S. Army Corps of Engineers was building a 36-foot channel across Lavaca Bay and the Matagorda Peninsula to provide a deepwater channel to the Gulf of Mexico for oceangoing ore ships by late 1963 or early 1964.

Iron Ore.—Brown iron ores were produced in Cass, Cherokee, and Morris Counties, with total output slightly lower than in 1961. Major markets for Texas iron ores were the State's two integrated steel mills. The portland cement industry required minor quantities.

The Houston plant of Sheffield Division of Armco Steel Corp. concluded its purchase contract for Mexican iron ore and increased shipments of Canadian ore and domestic pelletized ore from Reserve Mining Co. Sheffield completed its large combination slab and plate mill which could reduce 35-ton ingots into a slab 14 inches thick and 60 inches wide. The slab was then further reduced to steel plate, 4 inches thick and 12 feet wide. Accessory facilities included 16 new soaking pits, a new cooling bed to the merchant mill, and equipment necessary to operate the new units. The capacity of the Houston works blast furnace was raised 20 percent to 1,800 tons of pig iron per day by expanding the hearth size from 25 to 26.6 feet. Lone Star Steel Co. built additions to its administration and engineering buildings at Daingerfield. The company has diversified its line of products during the past several years, lessening its dependency on pipe markets of the oil and gas industry.

Magnesium.—The Freeport and Velasco plants of The Dow Chemical Co. produced magnesium metal. Output was greater as market demand increased and metal stocks declined. Principal uses were for aluminum alloys, as a reducing agent for titanium and zirconium purification, and for anodes in cathodic protection of underground pipelines and ship bottoms against corrosion.

Tin.—An electrolytic unit to recover tin from complex Bolivian ores was being added to the Texas City tin smelter of Wah Chang Corp. Completion was sheduled for mid-1963.

Uranium ore.—Uranium ores were produced in Karnes and Live Oak Counties and processed at the Susquehanna-Western, Inc., mill near Falls City.

REVIEW BY COUNTIES

This review is limited to those counties having significant mineral production or industry information.

Anderson.—The 1 percent rise in mineral value was caused by a slight increase in mineral fuels output. Exploration and development drilling resulted in major extensions of the Fairway-James Lime field, adding over 1,000 productive acres. Neches-Woodbine field produced 1.7 million barrels of crude oil, and Fairway-James Lime field produced 3.6 million. Three gasoline plants with combined capacity of 68 million cubic feet per day recovered natural gas liquids. Hunt Oil Co. was building a 30-million-cubic-foot-per-day refrigeration absorption unit and 50 miles of gathering lines in the Fairway field.

Andrews.—The county was the largest oil producer, led in total mineral value with $230.6 million, and ranked third in production value of natural gas liquids. The natural gas liquids were recovered at seven gasoline plants having a combined daily capacity of 367 million cubic feet. Pure Oil Co. completed a 6-million-cubic-foot-per-day gasoline plant to recover about 21,000 gallons of liquids per day. Pan American Petroleum Corp. expanded its Midland Farms

gasoline plant from 16 to 30 million cubic feet. There were 16 oilfields in the county, each of which produced more than 1 million barrels of crude oil. Two oil discoveries were made—Block A-49-Ellenburger and the Andrews, East-Strawn.

TABLE 23.—Value of mineral production in Texas, by counties [1]

County	1961 [2]	1962	Minerals produced in 1962 in order of value
Anderson	$22,430,800	$22,614,910	Petroleum, natural gas, natural gas liquids.
Andrews	225,180,600	230,622,320	Petroleum, natural gas liquids, natural gas.
Angelina	649,055	555,969	Clays, natural gas, petroleum.
Aransas	10,589,300	9,922,380	Petroleum, natural gas, natural gas liquids, shell.
Archer	28,024,300	28,570,280	Petroleum, natural gas liquids, natural gas, stone.
Atascosa	16,103,463	15,646,946	Petroleum, natural gas, natural gas liquids, sand and gravel.
Austin	6,322,560	6,353,927	Do.
Bastrop	836,036	847,054	Clays, petroleum, natural gas.
Baylor	8,411,500	7,268,584	Petroleum, natural gas, sand and gravel.
Bee	14,381,600	16,269,490	Natural gas, natural gas liquids, petroleum, stone.
Bell	394,872	(3)	Stone, sand and gravel.
Bexar	19,960,879	18,835,855	Cement, stone, sand and gravel, petroleum, clays.
Blanco	(3)	15,036	Sand and gravel.
Borden	30,081,172	25,813,294	Petroleum, natural gas, sand and gravel.
Bosque	31,807	1,045	Sand and gravel.
Bowie	(3)	(3)	Sand and gravel, natural gas, petroleum.
Brazoria	149,135,059	162,203,420	Petroleum, natural gas, magnesium chloride, natural gas liquids, bromine, salt, lime, magnesium compounds, sulfur, sand and gravel.
Brazos	102,900	115,400	Natural gas.
Brewster	8,700	(3)	Clays, gem stones.
Briscoe	(3)	46,000	Stone, clays.
Brooks	16,296,800	20,151,030	Natural gas, petroleum, natural gas liquids.
Brown	1,789,527	2,128,863	Petroleum, stone, natural gas, clays.
Burleson	19,250	18,720	Sand and gravel, petroleum.
Burnet	3,780,506	3,876,627	Stone, graphite.
Caldwell	7,941,500	9,416,400	Petroleum, natural gas.
Calhoun	17,784,217	22,198,217	Natural gas, petroleum, natural gas liquids, lime, shell.
Callahan	6,678,300	7,144,900	Petroleum, natural gas.
Cameron	240,700	477,400	Natural gas, petroleum.
Camp	1,118,800	1,440,000	Petroleum, natural gas.
Carson	30,205,200	29,996,100	Natural gas, petroleum, natural gas liquids.
Cass	7,373,155	12,823,407	Natural gas liquids, petroleum, natural gas, iron ore.
Chambers	59,334,076	59,648,803	Petroleum, natural gas, shell, salt, natural gas liquids.
Cherokee	7,563,000	6,903,744	Petroleum, iron ore, natural gas, natural gas liquids, clays.
Childress	150,600	762,056	Petroleum, stone, natural gas, sand and gravel.
Clay	13,606,990	12,271,990	Petroleum, natural gas, natural gas liquids, stone, sand and gravel.
Cochran	26,857,300	25,758,290	Petroleum, natural gas, natural gas liquids.
Coke	30,595,429	29,367,900	Petroleum, natural gas liquids, natural gas.
Coleman	12,014,998	10,471,754	Petroleum, natural gas, sand and gravel, natural gas liquids, clays.
Collin	42,900	240,500	Stone.
Collingsworth	1,134,200	884,700	Natural gas, sand and gravel.
Colorado	22,817,840	22,520,378	Natural gas liquids, natural gas, sand and gravel, petroleum.
Comal	(3)	4,406,586	Stone, lime, sand and gravel.
Comanche	269,170	272,773	Petroleum, natural gas, stone.
Concho	402,500	921,300	Petroleum, natural gas.
Cooke	30,419,553	29,701,688	Petroleum, natural gas liquids, natural gas, sand and gravel, stone.
Coryell	96,918	----------	
Cottle	431,800	7,500	Petroleum.
Crane	124,506,900	132,680,320	Petroleum, natural gas liquids, natural gas.
Crockett	24,761,000	23,318,240	Petroleum, natural gas, natural gas liquids.
Crosby	1,396,994	(3)	Sand and gravel, petroleum.
Culberson	3,663,250	3,751,132	Petroleum, natural gas, sand and gravel, stone, barite.
Dallam	124,600	141,500	Natural gas.
Dallas	17,303,476	17,817,086	Cement, sand and gravel, stone, clays.
Dawson	16,454,240	20,063,513	Petroleum, natural gas, natural gas liquids, stone.
Denton	543,751	572,034	Petroleum, natural gas, sand and gravel, clays.
DeWitt	8,505,360	8,472,577	Petroleum, natural gas, natural gas liquids, stone.
Dickens	327,029	169,100	Petroleum, sand and gravel, natural gas.
Dimmit	1,309,500	995,200	Petroleum, natural gas.

See footnotes at end of table.

TABLE 23.—Value of mineral production in Texas, by counties[1]—Continued

County	1961 [2]	1962	Minerals produced in 1962 in order of value
Donley	$208,600	$66,900	Sand and gravel, natural gas.
Duval	38,526,897	35,247,635	Petroleum, natural gas, salt, natural gas liquids.
Eastland	5,306,588	4,722,627	Petroleum, natural gas liquids, natural gas, clays, stone.
Ector	220,638,386	210,047,973	Petroleum, natural gas liquids, natural gas, cement, stone, clays.
Edwards	9,790	1,700	Petroleum.
Ellis	(3)	(3)	Cement, stone, clays.
El Paso	5,474,825	5,286,138	Cement, stone, sand and gravel.
Erath	1,804,628	2,266,012	Natural gas, natural gas liquids, stone, petroleum.
Falls	70,500	121,471	Stone, petroleum, sand and gravel, natural gas.
Fayette	1,302,057	1,564,806	Sand and gravel, petroleum, clays, natural gas, stone.
Fisher	14,292,861	14,975,270	Petroleum, gypsum, natural gas, natural gas liquids, clays.
Floyd	5,300	(3)	Sand and gravel, petroleum.
Foard	2,772,000	2,987,500	Petroleum, natural gas.
Fort Bend	35,391,848	34,281,636	Petroleum, sulfur, natural gas, salt, natural gas liquids, clays, sand and gravel.
Franklin	17,686,000	13,709,290	Petroleum, natural gas liquids, natural gas.
Freestone	2,915,119	4,214,553	Petroleum, stone, natural gas, clays.
Frio	5,095,522	4,829,980	Petroleum, natural gas, natural gas liquids.
Gaines	89,150,350	90,957,962	Petroleum, natural gas, natural gas liquids, stone.
Galveston	39,142,881	42,599,828	Petroleum, natural gas, shell, natural gas liquids, clay, sand and gravel.
Garza	17,930,900	17,064,600	Petroleum, natural gas.
Gillespie	77,085	76,796	Sand and gravel, stone, soapstone.
Glasscock	4,856,900	5,228,600	Petroleum, natural gas.
Goliad	8,933,200	9,235,920	Natural gas, petroleum, natural gas liquids.
Gonzales	278,119	445,540	Petroleum, clays, sand and gravel, natural gas.
Gray	62,946,500	57,821,150	Petroleum, natural gas, natural gas liquids.
Grayson	20,971,578	27,456,255	Petroleum, natural gas liquids, stone, natural gas, sand and gravel.
Gregg	97,100,800	94,845,770	Petroleum, natural gas liquids, natural gas.
Grimes	53,480	41,700	Natural gas.
Guadalupe	13,304,862	12,094,513	Petroleum, natural gas, sand and gravel, clays.
Hale	4,042,700	1,376,500	Petroleum, natural gas.
Hall	132,000	----------	
Hamilton	100,470	86,745	Natural gas, stone.
Hansford	21,072,700	24,445,420	Natural gas, petroleum, natural gas liquids.
Hardeman	2,581,697	3,728,343	Petroleum, gypsum, sand and gravel.
Hardin	25,845,477	27,475,434	Petroleum, natural gas, natural gas liquids, lime.
Harris	104,090,097	101,176,876	Petroleum, cement, natural gas, natural gas liquids, salt, lime, sand and gravel, clays, stone.
Harrison	23,002,601	23,400,946	Natural gas, petroleum, natural gas liquids, coal, clays, stone.
Hartley	2,285,700	2,113,200	Natural gas, petroleum.
Haskell	12,863,000	13,626,200	Petroleum, natural gas.
Hays	(3)	7,127	Stone.
Hemphill	481,152	543,500	Petroleum, natural gas.
Henderson	5,758,883	13,374,202	Petroleum, natural gas, natural gas liquids, sand and gravel, clays.
Hidalgo	30,285,860	31,682,633	Natural gas, natural gas liquids, petroleum, sand and gravel, stone, clays.
Hill	206,015	74,330	Stone, petroleum.
Hockley	30,121,900	31,221,080	Petroleum, natural gas liquids, natural gas.
Hood	17,046	----------	
Hopkins	5,741,428	5,544,698	Petroleum, natural gas liquids, natural gas, clays.
Houston	1,938,403	3,830,100	Petroleum, natural gas, sand and gravel.
Howard	42,534,833	42,414,802	Petroleum, natural gas liquids, natural gas, sand and gravel, stone.
Hudspeth	475,863	988,725	Talc, sand and gravel, stone, gypsum.
Hunt	20,200	134,500	Natural gas, petroleum.
Hutchinson	60,489,667	61,924,381	Petroleum, natural gas liquids, natural gas, sand and gravel, stone, salt.
Irion	2,502,300	2,227,940	Petroleum, natural gas, natural gas liquids.
Jack	16,729,418	18,280,010	Petroleum, natural gas, stone, natural gas liquids.
Jackson	43,255,085	43,998,600	Petroleum, natural gas, natural gas liquids.
Jasper	2,273,800	2,398,260	Do.
Jefferson	66,995,136	69,165,999	Petroleum, sulfur, natural gas, natural gas liquids, salt, sand and gravel, clays.
Jim Hogg	15,072,000	17,511,910	Petroleum, natural gas, natural gas liquids.
Jim Wells	58,039,200	56,848,990	Do.
Johnson	1,408,457	1,569,721	Stone, lime, sand and gravel.
Jones	17,558,254	18,179,537	Petroleum, natural gas, natural gas liquids, sand and gravel, stone.
Karnes	13,608,626	13,353,051	Petroleum, natural gas, natural gas liquids, uranium, gem stones.
Kaufman	1,929,526	1,841,537	Petroleum, stone, natural gas.
Kendall	38,078	9,016	Sand and gravel.

See footnote at end of table.

TABLE 23.—Value of mineral production in Texas, by counties[1]—Continued

County	1961[2]	1962	Minerals produced in 1962 in order of value
Kenedy	$3,491,100	$4,485,120	Natural gas, petroleum, natural gas liquids.
Kent	26,390,350	26,112,700	Petroleum, natural gas, sand and gravel.
Kerr	(3)	(3)	Sand and gravel.
Kimble	26,467	19,294	Natural gas, sand and gravel, petroleum.
King	3,207,900	3,246,900	Petroleum, natural gas, sand and gravel, stone.
Kleberg	57,561,900	67,889,430	Petroleum, natural gas liquids, natural gas.
Knox	7,986,800	6,827,800	Petroleum, natural gas.
Lamb	3,071,100	5,218,630	Petroleum, natural gas, stone.
Lampasas	24,016	33,276	Sand and gravel.
La Salle	1,512,522	1,385,200	Petroleum, natural gas.
Lavaca	12,795,981	16,991,429	Natural gas liquids, natural gas, petroleum, stone.
Lee	91,500	64,300	Petroleum, natural gas.
Leon	3,383,087	4,234,629	Petroleum, natural gas, stone.
Liberty	45,093,879	34,490,653	Petroleum, sulfur, natural gas, sand and gravel, natural gas liquids.
Limestone	1,755,147	2,210,684	Natural gas, petroleum, stone, clays.
Lipscomb	1,586,700	4,065,200	Petroleum, natural gas.
Live Oak	17,200,896	20,289,965	Natural gas, natural gas liquids, petroleum, uranium.
Llano	144,547	1,633,441	Stone.
Loving	10,659,100	11,397,300	Petroleum, natural gas.
Lubbock	1,607,615	1,322,602	Petroleum, sand and gravel, natural gas.
Lynn	1,498,400	1,695,500	Petroleum, natural gas.
Madison	1,366,512	1,821,230	Petroleum, natural gas, natural gas liquids.
Marion	6,209,800	5,453,220	Do.
Martin	6,229,900	7,113,000	Petroleum, natural gas.
Mason	12,024	10,533	Sand and gravel.
Matagorda	44,719,336	48,744,323	Natural gas, petroleum, natural gas liquids, shell, sand and gravel, clays.
Maverick	3,065,200	2,479,190	Petroleum, natural gas liquids, natural gas.
McCulloch	(3)	(3)	Sand and gravel, natural gas, petroleum.
McLennan	4,728,313	5,164,429	Cement, sand and gravel, stone, clays, petroleum, natural gas.
McMullen	9,669,700	9,809,820	Natural gas, petroleum, natural gas liquids.
Medina	940,360	1,317,100	Petroleum, natural gas, clays.
Menard	327,900	395,830	Petroleum, natural gas, sand and gravel.
Midland	58,603,900	65,214,790	Petroleum, natural gas liquids, natural gas.
Milam	(3)	(3)	Coal, petroleum, sand and gravel.
Mitchell	7,306,410	7,046,674	Petroleum, natural gas, sand and gravel, stone.
Montague	18,789,434	19,817,612	Petroleum, natural gas liquids, natural gas, stone, sand and gravel.
Montgomery	27,088,521	26,495,637	Petroleum, natural gas, natural gas liquids, sand and gravel.
Moore	47,553,279	57,255,555	Natural gas, natural gas liquids, helium, petroleum.
Morris	(3)	(3)	Iron ore.
Motley	1,522,231	1,191,839	Petroleum, sand and gravel.
Nacogdoches	3,032,175	3,112,346	Natural gas, clays, natural gas liquids, petroleum.
Navarro	6,521,064	6,777,118	Petroleum, natural gas, stone, sand and gravel, clays.
Newton	5,261,300	7,874,260	Petroleum, natural gas liquids, natural gas.
Nolan	26,828,192	26,821,301	Petroleum, cement, natural gas liquids, gypsum, natural gas, stone, sand and gravel.
Nueces	73,218,983	75,899,365	Natural gas, petroleum, natural gas liquids, cement, lime, shell, sand and gravel, clays.
Ochiltree	20,723,800	21,160,070	Petroleum, natural gas, natural gas liquids.
Oldham	581,588	(2)	Sand and gravel, petroleum, natural gas.
Orange	13,073,194	13,234,190	Petroleum, natural gas, cement, natural gas liquids, clays.
Palo Pinto	3,102,353	2,728,944	Natural gas, natural gas liquids, petroleum, clays, sand and gravel.
Panola	48,865,100	49,784,670	Natural gas, natural gas liquids, petroleum.
Parker	2,469,572	2,631,952	Natural gas liquids, natural gas, stone, clays, petroleum.
Pecos	59,951,562	60,314,171	Petroleum, natural gas, natural gas liquids, stone, gem stones.
Polk	5,078,767	4,618,030	Petroleum, natural gas, sand and gravel, natural gas liquids.
Potter	12,191,340	13,824,952	Natural gas, helium, natural gas liquids, sand and gravel.
Raines	200	1,900	Natural gas.
Reagan	26,895,900	25,331,960	Petroleum, natural gas liquids, natural gas.
Real	----------	51,946	Sand and gravel.
Red River	117,600	93,200	Petroleum, natural gas.
Reeves	7,803,056	8,462,216	Petroleum, natural gas, natural gas liquids, stone.
Refugio	64,460,700	70,117,650	Petroleum, natural gas, natural gas liquids.
Roberts	5,426,300	5,441,300	Petroleum, natural gas.
Robertson	417,993	484,177	Sand and gravel, petroleum, clays, natural gas.
Rockwall	42,800	----------	

See footnotes at end of table.

TABLE 23.—Value of mineral production in Texas, by counties[1]—Continued

County	1961 [2]	1962	Minerals produced in 1962 in order of value
Runnels	$16,351,900	$15,346,790	Petroleum, natural gas, natural gas liquids.
Rusk	64,251,300	61,205,940	Petroleum, natural gas, natural gas liquids, clays.
Sabine		1,224	Sand and gravel, natural gas.
San Augustine	100	2,300	Petroleum, natural gas.
San Jacinto	1,759,025	1,811,095	Petroleum, natural gas, sand and gravel, stone.
San Patricio	48,427,761	44,998,147	Petroleum, natural gas, natural gas liquids, sand and gravel, stone, clays.
Schleicher	11,444,700	11,987,810	Petroleum, natural gas, natural gas liquids.
Scurry	106,960,500	103,695,050	Petroleum, natural gas liquids, natural gas, clays.
Shackelford	11,129,900	10,907,140	Petroleum, natural gas, stone, natural gas liquids.
Shelby	1,238,800	1,236,000	Natural gas, petroleum.
Sherman	18,473,200	18,129,500	Do.
Smith	12,486,870	9,905,750	Petroleum, natural gas, natural gas liquids, clays sand and gravel.
Somervell		40,000	Stone.
Starr	27,595,014	29,329,656	Petroleum, natural gas, natural gas liquids, sand and gravel, pumice, clays, gem stones.
Stephens	10,161,910	9,150,365	Petroleum, natural gas liquids, natural gas, stone, sand and gravel.
Sterling	2,568,500	3,112,700	Petroleum, natural gas.
Stonewall	20,051,800	18,533,770	Petroleum, natural gas liquids, natural gas.
Sutton	697,390	619,100	Natural gas, petroleum.
Tarrant	8,029,538	10,446,140	Cement, sand and gravel, stone, clays.
Taylor	15,703,862	13,979,204	Petroleum, natural gas, sand and gravel, stone, clays.
Terrell	3,229,520	3,343,000	Natural gas.
Terry	18,437,331	18,563,266	Petroleum, sodium sulfate, natural gas, natural gas liquids.
Throckmorton	8,792,603	8,636,200	Petroleum, natural gas.
Titus	13,865,600	14,186,100	Do.
Tom Green	6,888,884	7,285,347	Petroleum, natural gas, sand and gravel, stone, natural gas liquids.
Travis	3,900,504	3,748,675	Lime, stone, sand and gravel, petroleum.
Trinity	20,649		
Tyler	2,436,300	2,402,600	Petroleum, natural gas.
Upshur	6,450,291	5,492,000	Petroleum, natural gas, sand and gravel.
Upton	50,136,000	48,324,600	Petroleum, natural gas liquids, natural gas.
Uvalde	(3)	(3)	Asphalt, stone, sand and gravel, natural gas.
Val Verde	750,200	626,000	Natural gas, petroleum.
Van Zandt	19,807,290	18,926,365	Petroleum, salt, natural gas, natural gas liquids.
Victoria	23,639,444	24,940,654	Petroleum, natural gas, sand and gravel, natural gas liquids.
Walker	352,796	183,025	Stone, clays, petroleum.
Waller	37,805,810	38,755,010	Natural gas, natural gas liquids, petroleum, sand and gravel.
Ward	67,123,016	71,119,337	Petroleum, natural gas, natural gas liquids, sodium sulfate, sand and gravel, salt, gypsum, stone.
Washington	601,475	555,145	Petroleum, natural gas, stone.
Webb	6,917,749	8,743,291	Petroleum, natural gas, natural gas liquids, sand and gravel, gem stones.
Wharton	49,397,197	47,866,810	Sulfur, petroleum, natural gas, natural gas liquids.
Wheeler	8,330,200	8,148,410	Petroleum, natural gas, natural gas liquids.
Wichita	35,765,460	34,275,660	Petroleum, natural gas liquids, natural gas, sand and gravel, stone.
Wilbarger	18,849,252	18,889,575	Petroleum, natural gas, sand and gravel, stone.
Willacy	6,670,700	6,702,800	Petroleum, natural gas, natural gas liquids.
Williamson	2,402,415	3,438,890	Stone, lime, petroleum.
Wilson	1,419,868	1,708,008	Petroleum, clays, natural gas.
Winkler	117,972,700	114,469,000	Petroleum, natural gas, natural gas liquids.
Wise	27,732,682	29,461,058	Petroleum, natural gas, natural gas liquids, stone, clays.
Wood	48,671,834	46,477,981	Petroleum, natural gas, natural gas liquids, sand and gravel.
Yoakum	49,222,647	49,749,326	Petroleum, natural gas liquids, natural gas, salt.
Young	18,235,402	18,116,616	Petroleum, natural gas, natural gas liquids, sand and gravel, stone.
Zapata	3,485,500	4,157,247	Natural gas, petroleum, natural gas liquids, stone.
Zavala	917,000	1,499,000	Petroleum, natural gas.
Undistributed	26,853,162	9,813,784	
Total	4,237,958,000	4,300,984,000	

[1] The following counties are not listed because no production was reported in 1961 or 1962: Armstrong, Bailey, Bandera, Deaf Smith, Delta, Fannin, Jeff Davis, Kinney, Lamar, Mills, Presidio, Randall, San Saba, and Swisher.

[2] Revised figures.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Angelina.—Total mineral value declined 14 percent as clay production dropped. An oil discovery, Platt Lower Pettit-Dry gasfield extended Pettit production 20 miles. Bentonite was mined from open pits near Zavala by Magnet Cove Barium Corp. and Bennett-Clark Co., Inc.

Aransas.—Changes in mineral fuels compilations contributed to the 6 percent decline in mineral value. Natural gas liquids were recovered at Pearce gasoline plant of Tenneco Oil Co. and Fulton Beach plant of Sun Oil Co. United Carbon Co., Inc., produced carbon black from both natural gas and distillates at its Aransas Pass channel and furnace plants. Shell was dredged from shallow bays by Heldenfels Bros.

Archer.—Mineral production rose 2 percent. Three oilfields were discovered. Hull-Silk-Sikes field produced 1.1 million barrels and Archer County Regular field produced 5.1 million barrels of crude oil. Natural gas liquids were recovered at the Holliday gasoline plant of Warren Petroleum Corp.

Atascosa.—Value of minerals produced fell 3 percent as production losses of crude oil and natural gas offset gains in natural gas liquids and sand and gravel. Humble Oil & Refining Co. recovered natural gas liquids at its Jourdantown gasoline plant. Sulfur was recovered from sour gas at units of Gillring Oil Co. and National Sulphur Co. Glass sand and other industrial sands were recovered from pits south of San Antonio by Espey Silica Sand Co. and West Land Silica Sand Co.

Austin.—There was little change in the county's mineral value. Building and paving sand and gravel were produced by Brazos River Sand & Gravel Co. and two other producers. Various producers prepared paving sand and gravel for the Texas Highway Department.

Bastrop.—Value of mineral output increased 1 percent over that of 1961. The county was the State's ranking clay producer. Fire clay was mined by open-pit methods near Elgin by Elgin Standard Brick Mfg. Co. and Payne Brick Co.

Bee.—Mineral fuels were responsible for the significant increase in mineral value. Natural gas liquids were recovered at the new Normanna gasoline plant of Tidewater Oil Co. and the cycling plant of Pan American Petroleum Corp.

Bexar.—Mineral value declined 6 percent because of decreases in cement, crude oil, and sand and gravel production. Bexar County was the second largest clay and stone producer and the third largest cement producer. Limestone was quarried and crushed for cement by Longhorn Portland Cement Co. and San Antonio Portland Cement Co. Principal uses were for concrete aggregate, roadstone, railroad ballast, riprap, and alkali production. Building and paving sand and gravel were reported by 13 producers; gravel tonnage was twice that of sand. Four producers mined clay, mostly shale, from open pits for use in manufacturing cement, lightweight aggregate, brick, and heavy clay products.

Brazoria.—Larger outputs of mineral fuels, salt, sulfur, lime, magnesium compounds, and magnesium chloride used for metal offset reduced outputs of sand and gravel and bromine, and resulted in a 9 percent rise in total 1962 mineral value. The county ranked first

in production of natural gas, lime, and salt; third in total mineral value; and fourth in natural gas liquids production. Oilfields producing more than 1 million barrels were: Hastings, East field—1.5 million barrels; Hastings, West field—5.9 million barrels; West Columbia field—1.4 million barrels; and West Columbia New field—1.2 million barrels. A new gas condensate field and a new gas pay proved productive off the deep flanks of the old Clemens Dome.

Three natural gasoline plants with combined daily capacity of 597 million cubic feet and the Pan American Petroleum Corp. Old Ocean cycle plant recovered natural gas liquids. Crude oil was processed at the Sweeny refinery of Phillips Petroleum Co., its subsidiary, Phillips Chemical Co., operated a petrochemical plant adjacent to the refinery. Frasch sulfur was shipped from a stockpile at Clemens Dome by Jefferson Lake Sulphur Co. The Dow Chemical Co. produced lime from shell and recovered salt in brine from a local salt dome. The company recovered magnesium compounds and produced magnesium chloride for manufacturing magnesium metal from sea water. Ethyl-Dow Chemical Co. recovered bromine from sea water to produce ethylene dibromide, an additive to antiknock gasoline fluids.

Brewster.—Carbonaceous shale, used as a soil conditioner and an agricultural mineral supplement, was produced by Manning Minerals Corp. Exploration projects for rare and base metals by individual prospectors were reported. A $500,000 fluorspar flotation mill to process imported "spar" from company-owned mines in Mexico was built at Alpine by Framspar, Inc. Initial employment was reported to be 40 persons.

Brooks.—The 24 percent rise in mineral value resulted from production gains by three mineral fuels. Crude oil production amounted to 2.9 million barrels and natural gas production to 91.3 million cubic feet. Humble Oil & Refining Co. recovered natural gas liquids at its Kelsey cycling plant. Carbon black was recovered at the Falfurrias channel plant of United Carbon Co., Inc.

Brown.—Increased output of natural gas and clay offset declines in crude oil and stone production to account for a 19 percent increase in total mineral value. G. C. McBride, Inc., quarried and crushed limestone for riprap, concrete aggregate, and roadstone. Over 300,000 tons of limestone was crushed and prepared as concrete aggregate and roadstone for the Texas Highway Department. Texas Brick Co. recovered shale for manufacturing brick and tile from open pits adjoining its plant at Brownwood.

Burnet.—There was a 3 percent increase in total mineral value compared with that of 1961. Graphite was mined and milled at Southwestern Graphite Co.'s open pit and flotation mill. Texas Construction Materials Co. and Pure Stone Co. quarried and crushed limestone for concrete aggregate, agriculture, and riprap. Texas Crushed Stone Co. quarried and prepared dimension granite and crushed granite.

Calhoun.—Production gains in mineral fuels and lime were responsible for a 25 percent increase in total mineral value. The increase in natural gas liquid recovery was the result of the new 10-million-cubic-foot-per-day gasoline plant in the North San Antonio Bay field of Cities Service Oil Co. and four other gas processing plants having

a combined daily capacity of 215 million cubic feet. Shell used to manufacture lime and cement was dredged from adjoining shallow bays by Bauer Dredging Co. and Smith Brothers Dredging Co., Inc. Bauxite ores from Surinam and the Dominican Republic were refined at three units of the Point Comfort refinery of Aluminum Company of America. A fourth refining unit nearing completion would process bauxite ores from Jamaica. Alumina produced was processed into metal at the company's Point Comfort reduction works and was also shipped to other company smelters. Alcoa produced lime from shell for use in its bauxite refining operations. A 45-million-pound-per-year vinyl acetate monomer plant was being built by National Starch & Chemical Corp. at Seadrift. Union Carbide Chemical Co. produced ethylene, polyethylene, and other petrochemical intermediates at its Seadrift plant.

Cameron.—Value of crude oil and natural gas produced was nearly 100 percent greater than in 1961. Barite and other soft nonmetallic minerals such as clay, talc, fluorspar, and phosphate rock were ground at mills of Magnet Cove Barium Corp., Division of Dresser Industries, and of Victoria Gin Co., Inc. The barite was imported from Mexico and Canada. A new 40- to 50-ton-per-day lime plant with a vertical kiln was placed in operation by Antex Milling Co., Inc. A relatively new lightweight aggregate and block plant operated at Brownsville. Delhi Taylor Oil Corp. processed crude oil at its Port Isabelle refinery. Such petrochemical derivatives as acetic acid, acetic anhydrides, and methyl and ethyl ketones were produced at the Brownsville petrochemical plant of United Carbon Chemical Corp.

Carson.—There was little change in mineral value for Carson County compared with that of 1961. Three gas processing plants with total daily capacity of 270 million cubic feet recovered natural gas liquids from the West Panhandle field. Panhandle Carson County field produced 4.0 million barrels of crude oil to raise the cumulative production of the field to 93.4 million barrels. Carbon black was recovered from natural gas at the Schoeber channel plant of Cabot Carbon Co.

Cass.—Value of minerals produced increased appreciably. Iron ore output was the third largest in the State. Natural gas liquids were recovered at Lodi gas processing plant of Breckenridge Gasoline Corp. and at the new 30-million-cubic-foot-per-day refrigeration absorption plant of Shell Oil Co., located in Bryans Mill field. Sulfur was recovered from a unit adjacent to the Shell Oil Co. gas processing plant. The company planned to add 42 million cubic feet of cycling capacity to its Bryans Mill plant.

Chambers.—Value of minerals produced remained at the same level. Oilfields producing in excess of 1 million barrels included Anahuac field—3.2 million barrels; Barbers Hill field—1.1 million barrels; and Oyster Bayou field—1.7 million barrels. Humble Oil & Refining Co. recovered natural gas liquids at its Anahuac gas processing plant. Shell for manufacturing inorganic chemicals and lime was dredged from shallow bays by W. D. Haden Co. and Parker Brothers Co. Diamond Alkali Co. recovered salt in brine for manufacturing chemicals.

Cherokee.—Natural gas, natural gas liquids, clays, and iron ore production increased. Natural gas liquids were recovered at the Neches gasoline plant of Humble Oil & Refining Co. General Refractories Co. recovered fire clay from open pits near Troup for manufacturing fire brick and refractory shapes. Iron ore was recovered from open pits near Jacksonville and Rusk by L. B. Haberle, Jennings & Halbert, and by Sheffield Steel Division of Armco Steel Corp.

Childress.—Increased output of sand and gravel, stone, crude oil, and natural gas caused an appreciable rise in mineral value. Crude oil production from Kirkland-Cisco Reef field was more than three times the initial discovery production.

Clay.—Value of mineral output was 10 percent less. Losses in crude oil, natural gas liquids, and stone production exceeded the increased output of natural gas and sand and gravel. Natural gas liquids were recovered at the Ringgold processing plant of Otha H. Grimes. Various producers quarried and crushed sandstone for concrete aggregate and roadstone for the Texas Highway Department. Graves-Mississippi oilfield was discovered.

Cochran.—There was a 4 percent decrease in the value of minerals produced as lower output of crude oil and natural gas liquids outweighed increased natural gas production. Levelland oilfield and Slaughter oilfield produced more than 5 million barrels each. Cities Service Oil Co. recovered natural gas liquids from Levelland gasfield at its Lehman gas processing plant. National Sulphur Co. began recovering sulfur at its 9-ton-per-day unit adjacent to the Lehman gasoline plant.

Coke.—The 4 percent decline in mineral value was the result of combined losses in mineral fuels and sand and gravel production. Oilfields producing in excess of 1 million barrels were Jameson-Strawn and Fort Chadbourne fields. Natural gas liquids were recovered at the Jameson gas processing plant of Sun Oil Co.

Coleman.—The 13 percent decline in mineral value resulted from losses in crude oil and natural gas which offset increased output of natural gas liquids, clay, and sand and gravel. Coleman County Regular field produced 1.1 million barrels of crude oil. A new gasfield, Glen Cove-Morris, was proven on the west flank of the Bend Arch. Four small gasoline plants recovered natural gas liquids. Martin Brick Co. produced shale from open pits for manufacturing brick, tile, and heavy clay products. Glass and industrial sand were prepared by Santa Anna Silica Sand Co., Inc.

Colorado.—Mineral value was 1 percent less than in 1961. Colorado County led in sand and gravel production. An output of 5.8 million tons of building and paving sand and gravel was reported by four companies from eight plants and by contractors for District 13 of the Texas Highway Department. Natural gas liquids were recovered at the Shell Oil Co. Provident City processing plant and Sheridan cycle plant and at the Tenneco Oil Co. Chesterville gasoline plant.

Comal.—Value of sand and gravel, stone, and lime produced was much greater than in 1961. Limestone was quarried and prepared from pits near New Braunfels by United States Gypsum Co. and near Ogden by Servtex Materials Co. for use as riprap, flux, concrete aggregate, railroad ballast, and agriculture. Lime was made from

limestone at the New Braunfels plant of United States Gypsum Co. Various producers quarried riprap for the U.S. Army Corps. of Engineers. Erhardt Kraft recovered sand and gravel from open pits.

Cooke.—Value of minerals produced was 2 percent less than in 1961; production losses in crude oil, natural gas liquids, and stone more than offset increased natural gas and sand and gravel output. Cooke County Regular field produced 3.2 million barrels of crude oil. Natural gas liquids were recovered at two gas processing plants. Exploratory drilling by the oil and gas industry proved Bob-K-Oil Creek field and four new pays. Nelson Brothers Sand & Gravel Co. supplied washed sand and gravel. Contractors quarried and crushed limestone for the Texas Highway Department.

Crane.—Value of minerals produced increased 7 percent. Crane County ranked third in mineral production value and in sulfur recovered from gas. Seven oilfields produced more than 1 million barrels each in 1962. Natural gas liquids were recovered from Waddell, McElroy, Sand Hills, and Cordona Lake gasfields at five gasoline processing plants having a combined daily capacity of 226 million cubic feet. Atlantic Refining Co. was adding 32,000-gallons-per-day liquid recovery facilities at its Block 31 processing plant. Sulfur was recovered from sour natural gas at the Crane plant of Phillips Chemical Co. and the Waddell plant of Warren Petroleum Corp.

Crockett.—Mineral fuels accounted for the 6 percent decrease in mineral value. A new gasfield, Southwest Ozona-Canyon, was discovered in Val Verde Basin. Natural gas liquids were recovered at Todd Ranch gasoline plant of Continental Oil Co. and the new West World gasoline plant of Cities Service Oil Co. Shell Oil Co. was building a $2 million gas processing plant with a daily capacity of 25 million cubic feet of gas to recover 18,000 gallons of propane and 24,000 gallons of natural gasoline.

Culberson.—Value of mineral production increased 2 percent. Barite was mined by open-pit methods at M&J mine, 25 miles north of Van Horn, and processed at the Continental Minerals Co. mill. Paving sand and gravel was prepared for the Texas Highway Department by various producers. Permian Sand & Gravel Co., Inc., quarried and crushed limestone for concrete aggregate and roadstone.

Dallas.—Mineral value in Dallas County rose 3 percent; increased outputs of clay, sand and gravel, and stone offset a decline in cement production. Cement and sand and gravel production were the second largest in the State. Portland and masonry cements were produced at the Dallas plant of Lone Star Cement Corp. and Eagle Ford No. 2 plant of Trinity Portland Cement, Division of General Portland Cement Co. Both companies quarried and crushed limestone and produced clay from their own pits. Shale was mined from open pits by Ferris Brick Co. and Dallas Lightweight Aggregate Corp. Perlite mined in New Mexico and Colorado was expanded at the Dallas plants of Texas Lightweight Products Co. and Texas Vermiculite Co. The latter company also expanded vermiculite from Montana and South Africa. Thirteen companies prepared sand and gravel for building and paving.

Abasco, Inc., converted aluminum scrap into ingots for the fabricating industry. Secondary lead and zinc smelters were operated by American Smelting & Refining Co. and Eagle Lead Co.

Dawson.—Mineral value increased nearly 22 percent, and the major gains were in crude oil and natural gas. An important new oilfield, TexHamon-Fusselman, was discovered in Midland Basin. Four significant new pays were developed which added substantial reserves in Montoya, Canyon, Strawn, and Mississippian horizons. Welch oilfield produced 2.1 million barrels of crude oil. Texaco, Inc., recovered natural gas liquids from Spraberry field at its Lamesa processing plant. Limestone was quarried and crushed near O'Donnell by Lone Star Materials, Inc., for concrete aggregate and roadstone.

Denton.—Mineral value increased by 5 percent through greater outputs of natural gas and sand and gravel which compensated for loss in clay production. Acme Brick Co. announced plans to build a 70,000-brick-per-day plant. Contractors produced paving gravel for the Texas Highway Department.

DeWitt.—Mineral output was essentially the same as in 1961. Natural gas output increased but crude oil output declined. Contractors quarried and prepared limestone for use as concrete aggregate and roadstone for the Texas Highway Department.

Duval.—Value of mineral fuels produced in Duval County declined 8 percent. The county was the fifth largest salt producer. Salt in brine was produced from wells near Benavides by the Chemical Division of Pittsburgh Plate Glass Co. Natural gas liquids were recovered at the Goliad Corp. Hagist gasoline plant and at the Trinity Gas Corp. Sejita cycle plant. Hoffman field produced 1.2 million barrels of crude oil. Two significant gas discoveries were made during 1962—Santo Nino-Wilcox dry gasfield and Rosita-Wilcox gas condensate field. Both discoveries were in the Lower Eocene.

Eastland.—Lower output of natural gas, natural gas liquids, and clay contributed to an 11 percent decline in mineral value. The mineral economy of Eastland County centered around the oil and gas industry. Four gasoline plants with a combined daily capacity of 67 million cubic feet recovered natural gas liquids. N. D. Gallagher Clay Products Corp. mined fire clay from open pits near Cisco. Shale was mined from open pits near Ranger by Featherlite Corp., Texas Lightweight Aggregate Co., and Texeramics, Inc. Limestone was quarried and crushed for riprap and concrete aggregate for the Texas Highway Department.

Ector.—The county was the ranking natural gas liquids producer and second in crude oil production and total mineral value. Crude oil, natural gas, and natural gas liquids accounted for nearly 98 percent of the county's total mineral value. Two oilfield discoveries, Harper and Circle Bar-Ellenburger, both in the Central Basin Platform, proved production in Strawn, Connell, Devonian, and Ellenburger horizons. Oilfields producing over 5 million barrels each were Cowden, North extending into Andrews County—6.1 milion barrels; Goldsmith field—6.3 million barrels; and Goldsmith-5,600—7.5 million barrels. Five gas processing plants with a total daily

capacity of 564 million cubic feet and one cycle plant recovered natural gas liquids from Headlee, Wheeler, TXL, and North Cowden fields. Crude oil was refined at the El Paso Natural Gas Co. refinery. El Paso Natural Gas Co. and Rexall Drug & Chemical Co. operated a petrochemical plant producing ethylene, propylene, polyethylene and other chemical derivatives. Carbon black was recovered from natural gas at the Odessa channel plant of Sid W. Richardson Carbon Co. Sulfur was recovered at five sour gas purification plants associated with natural gasoline plants.

The Texas Railroad Commission approved two waterflood projects, a 14,000-acre flood for Grayburg dolomite in the Foster field by Sunray DX Oil Co. and a waterflood project for the Grayburg-San Andres sand in the Foster field by Atlantic Refining Co. Western Oxygen, Inc., Division of American Cryogenics, began producing liquid oxygen, nitrogen, and argon at its new 35-ton-of-liquid-per-day Odessa plant.

Ellis.—Mineral value increased 3 percent over that of 1961. Expanded capacity and production of portland and masonry cement at the Midlothian plant of Texas Industries, Inc., accounted for much of the increase. Limestone was quarried and crushed for use in portland cement and concrete aggregate. Clay was mined from open pits by Acme Brick Co., Barron Brick Co., and Ferris Brick Co.

El Paso.—Output of minerals was 3 percent less in value than in 1961. Lower portland cement production was responsible for much of the decline. Portland and masonry cements were manufactured from company-produced raw materials at the El Paso plant of Southwestern Portland Cement Co. Limestone was quarried and crushed for concrete aggregate, roadstone, and riprap by McMillan Quarries, Inc., and Vowell Material Co. Sandstone was quarried and crushed for concrete aggregate and roadstone. Contractors prepared sand and gravel for the Texas Highway Department and the U.S. Army Corps of Engineers. Building, engine, and other industrial sands were prepared by El Paso Sand Products Co. and General Redi-Mix, Inc. Facilities to expand portland cement production were being added to the El Paso plant of Southwestern Portland Cement Co. at an estimated cost of $250,000.

Earth.—Mineral fuels dominated the mineral economy and were responsible for most of the 25 percent rise in total mineral value. Natural gas liquids were recovered at the 25-million-cubic-foot-per-day gas processing plant of Phillips Petroleum Co. Various producers quarried and crushed limestone for concrete aggregate and roadstone for the Texas Highway Department.

Fayette.—Increases in crude oil, natural gas, sand and gravel, and stone production raised the county's mineral value by 20 percent. Bentonite and fuller's earth were mined at open pits near Flatonia by Milwhite Co., Inc., Flatonia Fuller's Earth Co., and Balcones Minerals Corp. Building and paving sand and gravel were prepared at a fixed plant by Thorstenberg Materials Co. Sandstone and limestone were quarried and crushed for concrete aggregate by various producers for the Texas Highway Department.

Fisher.—The county was the second ranking gypsum producer. Advances in crude oil, natural gas, and clay production were re-

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sponsible for the 5 percent increase in mineral value. Natural gas liquids were recovered at four gas processing plants. Gypsum was quarried and processed near Longworth by Celotex Corp. and near Rotan by National Gypsum Co. for manufacturing wallboard, building plaster, and other building materials.

Fort Bend.—Value of the seven minerals and mineral fuels produced was 3 percent less than the 1961 value. Fort Bend County ranked as the third-place Frasch sulfur producer. Frasch sulfur was obtained from Orchard Dome by Duval Sulphur & Potash Co., and from sulfur stocks at Long Point Dome by Jefferson Lake Sulphur Co. Natural gas liquids were recovered at the Needville gas processing plant of Industrial Gas Supply Co. Salt in brine was taken from wells near Missouri City by United Salt Corp. The company evaporated salt at its Blue Ridge works. Texas Lightweight Aggregate Co. mined shale by open-pit methods near Missouri City for making lightweight aggregate. Contractors produced unprepared sand and gravel for use by the Texas Highway Department.

Franklin.—The mineral economy of Franklin County was dominated by the mineral fuels industry. Declines in crude oil and natural gas production more than counteracted advances in natural gas liquid output to account for a 22 percent decline. Talco field and Titus field each produced more than 1 million barrels of crude oil. Natural gas liquids and sulfur were recovered at the 50-million-cubic-foot-per-day New Hope adsorption cycling plant of Tidewater Oil Co.

Freestone.—Values of mineral fuels and stone produced rose appreciably from 1961 values. Central Texas Underground Storage, Inc., was developing two new storage cavities in the Butler salt dome. One cavity of 250,000-barrel capacity was being developed for propane storage and another of the same capacity was for combined butane and propane storage. Two other cavities were planned for 25,000 barrels each. Shale was mined from open pits for manufacturing brick and heavy clay products by Teague Brick & Tile Co. East Texas Stone Co. quarried and prepared sandstone for concrete aggregate, roadstone, and riprap. Contractors quarried and prepared miscellaneous stone and sandstone for road maintenance by the Texas Highway Department.

Frio.—Mineral value declined 5 percent because of lower crude oil and natural gas output. Natural gas liquids were recovered at the new 22-million-cubic-foot-per-day gas processing plant of Suburban Natural Gasoline Co. in West Big Foot field.

Gaines.—Mineral fuels were the county's principal minerals and were primarily responsible for the 2 percent increase in mineral value. The county was the fifth largest crude oil producer. Eight oilfields produced more than 1 million barrels of crude oil each. Wasson field was the leading producer with a total of 8.3 million barrels. Natural gas liquids were recovered at the Seminole gas processing plant of Phillips Petroleum Co. and the West Seminole processing plant of Cities Service Oil Co. Columbian Carbon Co. recovered sulfur at its No. 67 plant and produced carbon black from natural gas at its Seminole No. 66 channel plant. Elliot Taylor quarried and crushed limestone for concrete aggregate and roadstone.

Galveston.—The mineral economy of Galveston County revolved around mineral fuels, heavy chemicals, petrochemicals and such construction materials as clay, sand and gravel, and shell. Galveston and Texas City were focal points of the county's economy. The 9 percent increase in mineral value was caused by increased production of crude oil, natural gas, natural gas liquids, clay, and shell. Natural gas liquids were recovered at the Alta Loma gas processing plant of Margaret Hunt Trust Estate. Shell was dredged from shallow bays surrounding the county for the chemical industry and for concrete aggregate and roadstone. Contractors prepared paving sand for road maintenance for the City Engineer of Galveston and the Texas Highway Department. Three oilfields produced more than 1 million barrels of crude oil each; they were Gillock-South High Island, and Hull fields. Marathon Oil Co. added a 20,000-barrel-per-day catalytic cracker to its Texas City refinery. The company also planned $500,000 improvements at its recently acquired Plymouth Oil Co. refinery. A 600-ton-per-day ammonia plant was being built adjacent to the Texas City refinery of American Oil Co., with completion scheduled for mid-1963. The plant would produce anhydrous ammonia, principally as an agricultural fertilizer. Monsanto Chemical Co. (Hydrocarbon Division) was building a 45-million-pound-per-year vinyl acetate unit at its Texas City petrochemical plant. The new unit would use acetylene produced at the chemical plant. The company was also building a 50-million-pound-per-year linear polyolefin unit to use ethylene and propylene produced at the chemical plant. A third new facility being added to the Texas City plant was a 10-million-pound-per-year synthetic lactic acid unit, the first facility in the world to use a nonfermentation process. A 34-mile, 18-inch-diameter products pipeline was built by Service Pipeline Co. from the Texas City refinery of American Oil Co. to Pasadena. Foreign tin ores were processed at the Texas City smelter of Wah Chang Corp. The company was building an electrolytic tin smelting unit to process complex ores from Bolivia. Metals produced at the smelter included tungsten, titanium, tantalum, and other rare metals.

Gillespie.—There was little change in mineral production value. Soapstone was recovered from open pits near Willow City and processed at the Llano mill of Southwestern Talc Corp. Five sand and gravel operators produced building and paving sand and gravel, about half of which was washed. Universal Memorial Co., Inc., prepared rough granite for monumental use.

Goliad.—The 3 percent increase in mineral value was largely attributed to natural gas liquids recovered at the new 18-million-cubic-foot-per-day Milby gas processing plant of Banquete Gas Co. The gains in crude oil production were nullified by the decline in natural gas output.

Gonzales.—The value of mineral fuels, clays, and sand and gravel produced in Gonzales County rose appreciably. Southern Clay Products Co. and Baroid Division of National Lead Co. mined bentonite for manufacturing heavy drilling mud from open pits. Gonzales Gravel Co. produced building and paving sand and gravel.

Gray.—Value of mineral fuels produced in Gray County was 8 percent less than in 1961. Panhandle-Gray County field produced 11

million barrels of crude oil. Carbon black was recovered from natural gas at Coltexo channel plant of Columbian Carbon Co. and furnace black from liquid and natural gas at the Pampa plant of Cabot Corp. The Pampa petrochemical plant of Celanese Chemical Co. produced various ethyl, methyl, propyl, and vinyl derivatives from natural gas liquids. Six gasoline plants with a total daily capacity of 226 million cubic feet recovered natural gas liquids.

Grayson.—The value of minerals produced increased 31 percent. Higher output of crude oil and natural gas liquids exceeded the losses of natural gas and stone production. Natural gas liquids were recovered at the Sherman gasoline plant and at the new 22-million-cubic-feet-per-day adsorption gas cycling plant in New Mag field by Standard Oil Company of Texas. M. & K. Sand & Gravel Co. prepared building and paving sand and gravel. Limestone was quarried and crushed for use as concrete aggregate and roadstone by S. E. Evans, Inc., and Crusher, Inc.

Gregg.—The 2 percent drop in mineral value was the result of losses in crude oil and natural gas which more than offset increased natural gas liquid recovery. Gregg County was the sixth ranking oil producer. The giant East Texas oilfield extending into Cherokee, Rusk, and Upshur Counties produced 43.8 million barrels for a cumulative total of 3,550 million barrels since its discovery in 1930. Four gasoline plants with the daily capacity of 100 million cubic feet recovered natural gas liquids. Crude oil was processed at two refineries located at Longview.

Guadalupe.—Mineral value declined 9 percent because of production losses in crude oil and stone. Darst Creek oilfield produced 2.1 million barrels of crude. Acme Brick Co. produced shale from open pits for manufacturing brick and tile.

Hamilton.—Production losses in natural gas and stone caused the decline in mineral value. A 9-billion-cubic-foot underground natural gas storage reservoir was being developed by Lone Star Gas Co. in South Pottsville field, 13 miles southwest of Hamilton. This project brought the company's total storage in Texas to about 79 billion cubic feet. Contractors quarried and prepared limestone for use by the Texas Highway Department as concrete aggregate and roadstone.

Hansford.—Value of mineral fuels produced rose 16 percent. Phillips Petroleum Co. recovered natural gas liquids at its Sherman and Hansford gasoline plants. The company completed a 200-million-cubic-foot-per-day gas processing plant for annual recovery of 450 million cubic feet of helium. The plant, located 12 miles south of Guymon, Okla., was to process gas from the Texas Panhandle and part of Hugoton gasfield.

Hardeman.—Gains in crude oil and sand and gravel production were greater than losses in gypsum and stone output. As a result, total mineral production value increased 44 percent. A 1.5-million-cubic-foot gas processing plant was being built in Conley field east of Quanah by Shell Oil Co. Crude gypsum was mined and calcined near Acme by Bestwall Gypsum Co. for manufacturing wallboard, plaster, and other building products. Contractors prepared paving sand and gravel for the Texas Highway Department.

Hardin.—Increased production of mineral fuels accounted for a 6 percent rise in mineral value. Sour Lake and Village Mills East fields each produced more than 1 million barrels of crude oil. Natural gas liquids were recovered at No. 26 cycling plant and No. 25 gas processing plant of Sinclair Oil & Gas Co.

Harris.—Houston and Harris Counties were the nucleus of the largest industrial complex in Texas and the Southwest because of an abundance of essential natural resources, excellent harbor facilities, and adequate truck, rail, and water transportation systems that included the Houston Ship Channel and the Intercoastal Waterways. This industrial complex included such major resource-oriented industries as petroleum refining, industrial and organic chemicals, steel, cement, sulfur, and salt.

The county ranked sixth with total mineral value of $101.2 million. Four oilfields—Goose Creek, Pierce Junction, Tomball, and Webster—each produced in excess of 1 million barrels of crude oil. Six refineries with a daily capacity of 420,000 barrels of crude oil processed both domestic and foreign crudes. Natural gas liquids were recovered at five gas processing plants with a total daily capacity of 298 million cubic feet and at one cycling plant. Carbon black was recovered from hydrocarbon liquids at the Eldon furnace plant of J. M. Huber Corp.

Portland and masonry cements were produced at the Houston plants of Ideal Cement Co., Lone Star Cement Corp., Trinity Portland Cement Division of General Portland Cement Co., and Gulf Coast Portland Cement Co. The latter company completed its 1.5-million-barrel-per-year cement plant. Major markets were in the Houston metropolitan area, east Texas, and central Gulf Coast. Raw materials—shell and clay—were primarily from local sources. Iron ore required for cement making was from east Texas and gypsum used as a retarder was from west Texas. Most cement shipments were in bulk by truck. Lime was manufactured from shell by Champion Paper & Fibre Co. and Sheffield Division of Armco Steel Corp. Acme Brick Co., J. M. Cordell & Sons, and Houston Brick & Tile Co. mined shale from open pits for manufacturing brick, tile, and heavy clay products. Building and paving sand and gravel were prepared by Albers Bank Sand Co. and Horton & Horton. Various producers furnished unprocessed sand and gravel for highway maintenance for the Texas Highway Department. Slag from the Sheffield blast furnaces was crushed and prepared for road material by Houston Slag Material Co. Salt was mined by underground methods in a salt dome near Hockley by United Salt Corp. and was recovered as salt in brine from wells by Texas Brine Corp.

Sheffield Steel Division of Armco Steel Corp. operated its Houston integrated iron and steel plant at reduced capacity. Texas brown iron ore and out-of-State hematite were used as feed for the blast furnace. Ore production at the Linden pit in Cass County, was terminated. Production came from company pits in Cherokee County. The company began using pelletized taconite. A continuous casting machine and other modern facilities were planned for 1963 and 1964.

The Milwhite Co., Inc., and Baroid Division of National Lead Co. ground barite and other soft nonmetallic minerals such as fluorspar,

talc, bentonite, and celestite. Crude perlite from other States was expanded at Perlite of Houston, Inc., and The Tri-Lite Corp. Crude vermiculite from Montana and Africa was expanded for lightweight aggregate, concrete, and plaster by The Tri-Lite Corp. and Vermiculite Products, Inc. Sulfur was recovered from refinery gases by Shell Chemical Co., Sinclair Refining Co., and Stauffer Chemical Co. Most of the sulfur was used to manufacture sulfuric acid for various Gulf Coast industries.

Humble Oil & Refining Co. was adding 20-million-pound-per-year capacity to its plastic producing unit and planning a $6 million facility to produce basic alcohols and other oxo chemicals and a $3 million expansion of its butyl rubber facility. Enjay Chemical Co. Division of Humble Oil & Refining Co. increased propylene capacity from 40 to 75 million pounds per year and was adding ethyl benzene capacity to the Baytown plant. Humble Oil & Refining Co. boosted sulfuric acid capacity of the Baytown refinery by 1,000 barrels per day to a total of 18,000 barrels per day and increased benzene and toluene capacities to 55 million gallons each per year. Vinyl chloride monomer capacity of the Pasadena plant of Diamond Alkali Co. was raised from 75 to 100 million pounds per year. National Petro Chemical Corp., formed by National Distillers & Chemical Corp. and Owens-Illinois Glass Co., built a 60-million-pound-per-year polyethylene plant at Houston.

Nine oil companies organized Colonial Pipeline Co. to build a $350 million products pipeline from Houston to Staten Island, N.Y. The line would be approximately 1,600 miles long with an additional 1,000 miles of spur lines connecting with cities and markets along the right-of-way. The main trunk line would vary from 22 to 36 inches in diameter and would require over one-half million tons of steel. By midyear, Colonial Pipeline had contracted for 1,035 miles of 36-inch pipe for the section between Houston and Greensboro, N.C. A. O. Smith Corp. of Houston was one of four companies receiving orders for the pipe.

Harrison.—Value of mineral production gained 2 percent. Increases in natural gas, natural gas liquids, stone, and lignite production were greater than declines in crude oil and clay output. Six gas processing plants with combined daily capacity of 335 million cubic feet recovered natural gas liquids. Marshall Brick Co. mined shale from open pits and Marshall Pottery Co. mined clay for manufacturing brick, tile, and various ceramics. Atlas Chemical Industries, Inc., obtained lignite from the Darco mine near Marshall for preparing activated carbon. Various producers quarried and prepared miscellaneous stone for concrete aggregate and roadstone.

Henderson.—Important production gains in mineral fuels, clay, and sand and gravel contributed to the marked increase in the county's mineral value. Increased crude oil output resulted from the development of Fairway field. Opelita cycling plant of Lone Star Producing Co. recovered natural gas liquids. Fairway-James Lime field produced in excess of 1 million barrels of crude oil. Building and paving sand and gravel were produced by Turkey Creek Sand & Gravel Co. and Southwest Construction Materials Co. Fire clay for manufacturing fire brick, refractory shapes, and building bricks was mined from open

pits by Harbison-Walker Refractories Co., Athens Tile and Pottery Co., and Texas Clay Products Co. Miscellaneous clay was mined from open pits by Athens Brick Co. Texas Clay Tile Co. was planning a $650,000 brick and tile plant at Malakoff. Athens Brick Co., Inc., announced a $700,000 expansion program, including a new kiln, which would more than double its brick capacity. The company expected to produce solar, drain, and structural tile.

Hidalgo.—Increases in natural gas, natural gas liquids, sand and gravel, and stone production resulted in a moderate rise in mineral value. Hidalgo County was the fourth ranking natural gas producer. Three gasoline plants recovered natural gas liquids, and crude oil was processed at two refineries. Valley Brick & Tile Co. mined shale from open pits for manufacturing brick and tile. Building and paving sand and gravel were produced by The Fordyce Co. Various producers quarried and prepared limestone for concrete aggregate and roadstone for the Texas Highway Department.

Hockley.—Mineral fuels were responsible for all reported mineral production in the county. Slaughter oilfield, extending into Cochran and Terry Counties, produced 8.5 million barrels of crude oil to bring the cumulative total to 286 million barrels. Natural gas liquids were recovered from Slaughter and Levelland gasfields by three gasoline plants having a combined capacity of 145 million cubic feet daily. Pan American Petroleum Corp. recovered sulfur at its Slaughter gas processing plant.

Houston.—Significant gains in crude oil and natural gas production resulted in a substantial increase in mineral value. Pure Oil Co. was building a 50-mile, 8-inch oil pipeline to connect Fort Trinidad field in east Texas with its Van pipeline which served the Smith's Bluff refinery of the company near Beaumont. The pipeline would have an initial capacity of 10,000 barrels a day and an ultimate capacity of 30,000 barrels. The company planned to extend this line 20 miles further to the northwest to provide an outlet for OSR and Leona oilfields.

Howard.—There was little change in mineral value. Increased crude oil and natural gas output canceled declines in natural gas liquids and sand and gravel production. Carbon black was recovered from liquids at Dixon furnace plant of Cabot Carbon Co. and Big Spring furnace plant of Sid W. Richardson Carbon Co. Important oil-producing fields in the county were: Howard Glasscock—6.7 million barrels; Iatan, East Howard (extending into Mitchell County)—2.2 million barrels; and Snyder field—1.0 million barrels. Reef Corp. recovered natural gas liquids at its East Vealmoor gas processing plant. Building and paving sand and gravel were prepared by West Texas Sand & Gravel Co. and R. E. Janes Gravel Co., Inc. At Big Spring, the 20-million-pound-per-year styrene plant of Cosden Petroleum Corp. produced xylene and other chemical derivatives from naphtha fractions. The company refined crude oil at its Big Spring refinery.

Hudspeth.—Nonmetallic mineral production more than doubled in total value as production of sand and gravel, stone, and talc increased appreciably. The county was the leading talc producer with six producers recovering 71,135 tons. Pioneer Talc Co.,

subsidiary of Georgia Talc Co., completed the first talc-finishing mill in the west Texas area. The mill was located at Allamoore and had a capacity of 6.5 tons of finished talc per hour. Ground material was to be used for ceramic material, rubber, and roofing material. The mill operated on a custom basis, processing talc produced by other companies in the area. Gypsum, for use as a retarder in cement, was mined from open pits near Allamoore by Southwestern Portland Cement Co. Gifford-Hill & Co., Inc., quarried and crushed rhyolite for riprap, and roofing granules. Various producers prepared sand and gravel for concrete aggregate and roadstone for the Texas Highway Department.

Hunt.—Increased natural gas production accounted for the gain in total mineral value. An 11-million-cubic-foot-per-day sour gas processing plant to exhaust hydrogen sulfide and carbon dioxide from Smackover gas in Quinlan field was built by Paul C. Teas.

Hutchinson.—The 2 percent increase in mineral value resulted from production gains in sand and gravel, natural gas, and natural gas liquids. Panhandle-Hutchinson County oilfield produced 10.7 million barrels of crude oil for a cumulative total of 268.6 million barrels. Furnace blacks were recovered from liquid hydrocarbons at Phil-black No. 3 plant of Phillips Chemical Co. and furnace and channel blacks from both natural gas and liquids at the J. M. Huber plant. Six gas processing plants with a combined daily capacity of 714 million cubic feet recovered natural gas liquids. Crude oil was processed at the Phillips Petroleum Co. Plains refinery. Synthetic rubber was produced at Plains copolymer plant of Phillips Chemical Co. and butadiene, butylene, and propylene were produced at the company's butadiene plant. Building and paving sand and gravel were produced by Borger Sand & Gravel and Tri-City Sand & Gravel Co. Contractors quarried and prepared caliche for riprap and concrete aggregate for the Bureau of Reclamation.

Jack.—Larger output of crude oil nullified the loss of natural gas recovery and accounted for a 9 percent rise in total mineral value. Crude oil was processed by the Bryson Pipeline & Refining Co. refinery, and natural gas liquids were recovered at three gas processing plants. Two oilfields, Jack County Regular and Rusmag, each produced more than 1 million barrels of crude oil. Various producers quarried and prepared limestone for use as concrete aggregate and roadstone for the Texas Highway Department.

Jackson.—Increased production of natural gas and natural gas liquids offset loss of crude oil output for a 2 percent rise in total mineral value. The first oil and gas well in the world to produce from eight zones simultaneously was completed in Francitas field of Jackson County by Texaco, Inc. The record well, No. 1 Beckenhauer, consisted of four dual strings of 2⅞-inch tubing with four strings of 1¼-inch tubing inside each of the four larger sizes. Producing zones were all in Frio horizon with production from 687 to 7,800 feet. West Ranch-41–A Zone field produced 1.1 million barrels of crude oil. The cycling plant of Francitas Gas Co. and two gas processing plants recovered natural gas liquids.

Jefferson.—The county had the largest concentration of crude oil refining capacity and was the second largest Frasch sulfur pro-

ducer. The county was an important part of the dynamic petroleum refining and petrochemical complexes of the Gulf Coast area. Advances in crude oil, natural gas, and salt production nullified declines in natural gas liquids and sulfur production to result in a 3 percent increase in mineral value. Natural gas liquids were recovered at the Port gas processing plant of Port Gas Processing Co. Sulfur was recovered from refinery gases by Atlantic Refining Co., Gulf Oil Corp., and Olin Mathieson Chemical Corp. Crude Oil was refined at six refineries with a combined daily capacity of nearly 1 million barrels. Frasch sulfur was recovered from Fannett and Spindletop Domes by Texas Gulf Sulphur Co. Beaumont Brick Co., Inc., mined shale from open pits for manufacturing brick and tile. Building and paving sand and gravel were prepared by C. A. McKinley Sons, Inc. Atlantic Refining Co. increased its Port Arthur refining capacity from 63,000 to 85,000 barrels per day with the addition of a new oil distillation unit. A 22,500-barrel-per-day catalytic hydrodesulfurization unit was being built. A multimillion-dollar unit to produce a new type of synthetic rubber was being added to the Beaumont petrochemical plant of E. I. du Pont de Nemours & Co., Inc. The Port Arthur refinery of Gulf Oil Corp. began normal operations in January following the settlement of a 72-day strike by the International Association of Machinists. A second workers' union, the Oil, Chemical, & Atomic Workers, signed a 2-year contract following the agreement with the Machinists Union.

Jim Wells.—Mineral activity in Jim Wells County centered around mineral fuels with mineral value declining by 2 percent; lower output of crude oil and natural gas accounted for the loss. Four oilfields produced in excess of 1 million barrels each. Natural gas liquids were recovered at the LaGloria cycling plant of LaGloria Oil & Gas Co., Seeligson cycling plant of Socony Mobil Oil Co., Inc., and Orange Grove gas processing plant of Gas Processors, Inc.

Johnson.—Increased output of nonmetallic minerals—lime, stone, and sand and gravel—were responsible for the 11 percent advance in mineral value. Lime used in construction and chemical industries was manufactured by Texas Lime Co. from high-calcium limestone, quarried from its own pits. Various producers quarried and prepared limestone for highway maintenance by the Texas Highway Department.

Jones.—Mineral activity as measured by mineral value was 4 percent greater than in 1961. Crude oil and natural gas production gained, and the output of natural gas liquids, sand and gravel, and stone declined. Jones County Regular field produced 1.2 million barrels of crude oil. West Texas Stone Co. produced dimension limestone from quarries in Lueders. Building and paving sand and gravel were produced by R. E. Janes Gravel Co., Inc.

Karnes.—Mineral activity in the county consisted of crude oil, natural gas, natural gas liquids, and uranium ore production. Natural gas liquids were recovered at two gas processing plants of United Gas Pipe Line Co. Shell Oil Co. was building a 20-million-cubic-foot-per-day gas processing plant and a sulfur recovery unit in Persons

field. Sulfur was recovered by Warren Petroleum Corp. Uranium ore produced in the county was processed at the Susquehanna-Western, Inc., Falls City mill.

Kaufman.—Mineral value declined 5 percent. Production consisted of crude oil, natural gas, and stone. Various producers quarried and crushed limestone for concrete aggregate for the Texas Highway Department. Wesco Materials Corp. quarried and prepared limestone for riprap and concrete aggregate.

Kent.—Lower crude oil output essentially nullified increased natural gas production. Cogdell area field, extending into Scurry County, produced 4.7 million barrels of crude oil and Salt Creek field produced 3.1 million barrels. Senn Gravel Co. prepared building and paving sand and gravel.

Kleberg.—Increases in crude oil and natural gas production offset the loss in natural gas liquid production so that mineral value increased 18 percent. Natural gas liquids were recovered at King Ranch cycle plant of Humble Oil & Refining Co. and at May gas processing plant of Cities Service Oil Co.

Lamb.—Total value of mineral production was appreciably greater than that of 1961 because of increases in crude oil and natural gas output. Pioneer Pavers, Inc., quarried and prepared limestone for concrete aggregate and roadstone.

Lavaca.—Mineral output was nearly 33 percent greater in value as natural gas and natural gas liquids output increased, counteracting smaller losses in crude oil, stone, and sand and gravel production. Natural gas liquids were recovered at the Provident City gas processing plant of Shell Oil Co. and the Wilcox plant of Goliad Corp. Various producers quarried and prepared sandstone for concrete aggregate for the Texas Highway Department. Some limestone was also prepared for highway maintenance work.

Liberty.—Production losses of crude oil, natural gas liquids, and Frasch sulfur were responsible for the 24 percent decline in the county's total mineral value. Hankamer field produced 1.1 million barrels of crude oil and Liberty, South field produced 2.8 million barrels. Southwest Industries, Inc., recovered natural gas liquids at its Hull gasoline plant. Frasch sulfur was recovered from Moss Bluff Dome by Texas Gulf Sulphur Co. Texas Construction Materials Co. prepared building and paving sand and gravel.

Limestone.—Mineral production consisted of crude oil, natural gas, clays, and stone. Increases in natural gas and stone production nullified losses in crude oil output to result in a 26 percent increase in total mineral value. Barron Brick Co. mined miscellaneous clay from open pits for manufacturing building brick and heavy clay products. Various producers quarried and prepared limestone for concrete aggregate and roadstone for the Texas Highway Department. Natural gas liquids were recovered at Southwest Oleta gas processing plant of Southwest Oleta Gas Processing Corp.

Live Oak.—Increased output of natural gas, natural gas liquids, and uranium more than offset a slight decline in oil production to increase total mineral value 18 percent. Natural gas liquids were recovered at plants of Atlantic Refining Co. and Goliad Corp. Crude oil was processed by Three Rivers Refining Co.

Llano.—Only stone was produced. Dezendorf Marble Co. quarried and prepared marble for terrazzo, whiting, and roofing granules. Granite was quarried and prepared by two companies.

Madison.—Production gains of crude oil and natural gas more than offset declines in natural gas liquids and stone and resulted in a 33 percent gain. The State's first 320-acre oil spacing was approved for Fort Trinidad (Glen Rose) field, Madison and Houston Counties. Halliburton Co. started operating its bulk cement plant at Midway, Tex. The cement was to be used by the company in oil-well cementing.

Matagorda.—The mineral industry continued its dynamic growth of the past few years and increased about 9 percent in total value. Impressive production gains were made by petroleum, natural gas, and natural gas liquids. Celanese Corporation of America began producing petrochemicals at its $15 million plant, and consideration was given to expanding the plant to increase product lines. Natural gas liquids were recovered at the Bay City gasoline plant of Marathon Oil Co., the Leabo plant of Tenneco Oil Co., and the new 18-million-cubic-foor-per-day Sun Oil Co. cycling plant in Midfield field. Shell for aggregate and road surfacing was dredged from shallow bays by Matagorda Shell Co. Pal-Port Clay Products Corp. mined shale from open pits.

Maverick.—Reduced output of petroleum accounted for the 19 percent decrease in total value. A new 2.5-million-cubic-foor-per-day refrigeration plant in Chittim Ranch field was constructed by Continental Oil Co. Fluorspar from Mexico was milled at Eagle Pass flotation mill of Reynolds Metals Corp. for eventual use in manufacturing cryolite. Tejas Barite, Inc., processed and ground barite, fluorspar, celestite, and other soft nonmetallic minerals.

McCulloch.—Industrial sands were prepared by Pennsylvania Glass Sand Co. and Heart of Texas Mining Corp. A subsidiary of Tex-Star Oil Co., Heart of Texas Mining Corp. expanded its production by selling to markets previously serviced by out-of-State producers.

McLennan.—Portland and masonry cements were produced from limestone and clay mined from open pits at the Waco plant of Universal Atlas Cement Division of U.S. Steel Corp. Four sand and gravel producers prepared building and paving sand and gravel. Production of lightweight aggregate began at the Waco Aggregate Co. plant. Shale was mined from a pit located north of the plant. Two 8- by 120-foot natural-gas-fired kilns, each with a daily capacity of 125 tons, were utilized. Acceptance of the lightweight aggregate was excellent. Material was available in 1-inch, 5/8-inch, 3/16-inch, and 35-mesh sizes.

McMullen.—Trans-Jeff Chemical Corp. more than doubled the capacity of its sulfur recovery plant at Tilden. Increased output of natural gas offset losses in crude oil and natural gas liquids to account for the slight rise in mineral value.

Medina.—Mineral outputs of crude oil and natural gas increased as clay production declined, resulting in a 40 percent rise in mineral value. D'Hanis Brick & Tile Co. mined shale from open pits for manufacturing building brick, tile, and heavy clay products.

Midland.—Value of mineral fuels produced increased over 11 per-

cent. Spraberry Trend Area oilfield accounted for over 40 percent of the total oil production in the county. Natural gas liquids were recovered at plants of Cities Service Oil Co., Mobil Oil Co., and Phillips Petroleum Co. Crude perlite from New Mexico was expanded by Perlite Industries, Inc., for use in building plaster, as loose-fill insulation, and as filter aids.

Mitchell.—Mineral value was 4 percent less than the 1961 value. Reduced output of crude petroleum was responsible for the drop. Building and paving sand and gravel were prepared by Colorado Sand & Gravel Co. Collins Construction Company of Texas quarried limestone for noncommercial use.

Montague.—Total mineral value increased 5 percent. Natural gas liquids production increased and other commodities held relatively stable. Sadler Sand & Gravel Co. prepared building sand. Contractors quarried and crushed limestone for District 3 of the Texas Highway Department. Bowie gasoline plant of Bowie Gasoline Co. recovered natural gas liquids.

Montgomery.—Reduced production of petroleum, natural gas, and stone accounted for the 2 percent decline in mineral value. Natural gas liquids were recovered at the Lake Creek plant of Superior Oil Co. Plants of Humble Oil & Refining Co., Midland Gasoline Corp., Sinclair Oil & Gas Co., and Warren Petroleum Corp., having a total daily capacity of 96 million cubic feet, also recovered natural gas liquids. Distillates were burned to recover furnace carbon black at No. 63 Conroe plant of Columbian Carbon Co.

Moore.—All minerals produced in the county recorded significant advances from 1961. Increased output of natural gas liquids and helium accounted for most of the gain. Seven gasoline plants, with combined daily capacity of 1,460 million cubic feet, recovered natural gas liquids from West Panhandle and Texas-Hugoton fields. The Phillips Petroleum Co. helium plant near Dumas was being tested during most of 1962, but small amounts of helium were shipped to Government storage facilities near Amarillo. The Government-owned and operated Exell plant recovered helium from natural gas. Sulfur was recovered from sour natural gas and refinery gas at the McKee plant of Shamrock Oil & Gas Corp.

Morris.—Lone Star Steel Co. continued the diversification of its product line. Construction of additional facilities at its administration and engineering offices was completed. Brown iron ore was mined from open pits near Lone Star by Lone Star Steel Co.

Navarro.—Increased crude oil production was responsible for the 4-percent increase in total mineral value. All nonmetallic minerals reported decreased in output. Whiteselle Brick & Lumber Co. mined miscellaneous clay for manufacturing brick and heavy clay products. Contractors quarried and prepared limestone for District 18 of the Texas Highway Department. Wesco Materials Corp. reported sand and gravel production.

Newton.—Production from a new gas processing plant resulted in a 50-percent increase in mineral value. Increases were also reported in crude petroleum and natural gas output.

Nolan.—Total mineral value remained unchanged from 1961. Crude petroleum, natural gas liquids, stone, and gypsum increased output. Nolan County was the leading producer of gypsum. Crude

gypsum was mined from open pits near Sweetwater and prepared by The Flintkote Co. and United States Gypsum Co. Lone Star Cement Corp. quarried high-calcium limestone and mined clay from open pits for manufacturing portland and masonry cement at its Maryneal plant. Limestone was quarried and crushed by various producers for highway construction. Building and paving sand and gravel for construction were produced by Hillsdale Gravel Co.

Nueces.—The county ranked second in lime production. Increased output of mineral fuels and lime was responsible for the 4-percent increase in value. Sinclair Refining Co. closed its petroleum refinery at Corpus Christi and sold the 37,000-barrel-per-day refinery to Coastal States Petrochemical Co. of Corpus Christi for $9 million. Suntide Refining Co. placed its new styrene unit on stream at Corpus Christi. The unit could produce 60 million pounds of styrene annually. Celanese Chemical Co. operated its large petrochemical plant at Bishop, using natural gas and LP gases to produce synthetic organic chemicals, acetic acid, acetone, methanol, and numerous other methyl, propyl, and butyl derivatives. Shell was dredged from shallow bays bordering Nueces County by Corpus Christi Shell Co., Inc., General Dredging Corp., Heldenfels Brothers, and Matagorda Shell Co., Inc. Halliburton Portland Cement Co. operated two kilns. Heldenfels Brothers and M. P. Wright, Jr., prepared building and paving sand and gravel from pits near Corpus Christi. Robstown Clay Products Co. used shale for lightweight aggregate. Crude barite from domestic and foreign sources was crushed and ground at the Corpus Christi plant of the Baroid Division of National Lead Co. for use in heavy drilling muds. Demand for processed barite decreased because of less drilling by the oil and gas industry in the Gulf area and in west Texas.

Ochiltree.—There was a 2-percent rise in mineral value. Output of petroleum declined and natural gas and natural gas liquids production increased slightly. Two gas plants, having a combined daily capacity of 248 million cubic feet, recovered natural gas liquids from Hansford and various fields within the county.

Orange.—Increased production value of natural gas, clays, and cement was reported. Alpha Portland Cement Co. acquired the Texas Portland Cement Co. plant at Echo for a reported $4.25 million. Alpha Portland planned to increase the annual productive capacity of the plant from 680,000 to 2 million barrels. Furnace carbon black was recovered from liquid hydrocarbon at Echo Phil-black plant of Phillips Chemical Co.

There was important new construction of chemical and petrochemical plants in the county. E. I. du Pont de Nemours & Co., Inc., was building a plant to produce low-density polyethylene and vinyl resin at Orange, with completion scheduled for late 1963. Dayburn Chemical Co. purchased land to build a chemical plant at Port Neches. Late in 1962, Firestone Synthetic Rubber & Latex Co., Division of Firestone Tire & Rubber Co., began limited production at new facilities in its Orange plant. Its expansion program included the construction of a butadiene unit.

Palo Pinto.—Except for natural gas, declines in output were reported for all minerals, with a resulting 12-percent loss in overall value. Southwest Gas Pipeline Co. expanded its natural gas liquids plant to process 35 million cubic feet daily. A total of 120,000 tons of mis-

cellaneous clay for brick, tile, and heavy clay products was mined from open pits near Strawn by Bill Williams Materials Corp. and Reliance Clay Products Co. and from pits near Mineral Wells by Texeramics, Inc., and Texas Vitrified Pipe Co. Mineral Wells Sand & Gravel Co. produced building and paving sand and gravel from pits near Mineral Wells.

Panola.—A substantial increase in crude petroleum output and a slight gain in production of natural gas liquids offset lower natural gas production and accounted for the 2-percent increase in total mineral value. Five gasoline plants with daily production capacity of 890 million cubic feet recovered natural gas liquids.

Parker.—Lone Star Gas Co. recovered natural gas liquids at its Springtown gasoline plant. A new gasfield was discovered in the county. The Bonsville Conglomerate (Marble Falls) at 5,400 feet heightened interest in geophysical activity. District 2 of the Texas Highway Department had limestone quarried and prepared by contractors for aggregate and roadstone. Industrial Concrete & Supply Co. mined limestone for concrete aggregate. Ben Roy Gholson quarried and prepared sandstone for rough construction. Acme Brick Co. and Mineral Wells Clay Products Co. mined miscellaneous clays from open pits for brick and tile.

Pecos.—The county was an important source of crude oil and natural gas. During 1962, Yates oilfield produced 4.9 million barrels of crude oil. The new 3-million-cubic-foot refrigeration-absorption gasoline plant of Marathon Oil Co. recovered natural gas liquids from gases in Yates field. Natural gas liquids were recovered from Santa Rosa and Puckett fields by four gasoline plants with a capacity of 289 million cubic feet per day.

Potter.—Increased natural gas liquids and helium output offset losses in natural gas and sand and gravel production, resulting in an appreciable rise in mineral value. Helium was recovered from natural gas at the Government-owned and operated Amarillo plant. Crude oil was refined at the Amarillo refinery of Texaco, Inc. Fain and Turkey Creek gasoline plants of Amarillo Oil Co. recovered gasoline liquids from the West Panhandle field. Texas Sand & Gravel Co., and Panhandle Gravel, Inc., produced building and paving sand and gravel. Southwestern Portland Cement Co. began constructing an $8 to $10 million cement plant on a 2,200-acre site 14 miles west of Amarillo near Bushland. Production was to start in late 1963.

Zinc was recovered from zinc ore concentrates shipped from western States and Mexico to the horizontal retort smelter of American Smelting & Refining Co. Metal stocks were high in 1962 and demand for high-grade zinc was off. The company had an adequate concentrate supply.

Reagan.—Reduced output of petroleum accounted for the 6 percent decline in mineral value. The quantity of natural gas liquids recovered at three gasoline plants increased. Sulfur was recovered from sour natural gas at the Barnhart plant of Northwest Production Corp.

Reeves.—Output of minerals was 8 percent greater in value than in 1961. Three small oil pays were opened. They were Waha, West-

6,050 sand; Waha, West-6,450 sand; and South Worsham-Delaware, Lower. The Phillips Petroleum Co. Tunstill gasoline plant recovered natural gasoline liquids from various fields.

Refugio.—Mineral activity, which consisted entirely of mineral fuels production, reported a 9 percent increase in value. Three-fourths of the gain resulted from increased petroleum output. Natural gas liquids were recovered at three gasoline plants with combined daily capacity of 270 million cubic feet. Mission River Corp. began a $300,000 gas processing plant at Refugio. Capacity of the plant would be approximately 15 million cubic feet of gas daily.

Runnels.—A new shallow pay was developed at Kendrick-Morris field and an extension of West Urban-Upper Strawn oilfield was reported. Three gasoline plants recovered natural gas liquids.

Rusk.—The 5 percent decline in mineral value resulted from lower output of petroleum, natural gas liquids, and clay. Henderson Clay Products Co. and Major Brick Co. mined clay. Four gasoline plants, with a combined product capacity of 125 million cubic feet daily, recovered natural gas liquids.

San Jacinto.—The 3 percent rise in total mineral value was the result of increased sand and gravel output which offset a slight decline in mineral fuels production. Building and paving sand and gravel from pits near Shepherd were produced by Thorstenberg Materials Co.

San Patricio.—Reduced production of crude oil accounted for most of the 7 percent decline in mineral value. At least two new oilfields and four gas condensate fields were discovered at North Midway-Frio (Frio). There were no marked changes in operation or in equipment at the Reynolds Metals Co. aluminum plant. Four gasoline plants, having combined capacity of 265 million cubic feet daily, recovered natural gas liquids. A new gasoline plant, owned by Conquette Gas Co. and American Gas Processing Co., was completed in late 1962. Capacity would be 6 million cubic feet daily. Sunray DX Oil Co. was operating the first underwater secondary recovery project in the State in Red Fish Bay, 3 miles south of Ingleside.

Heldenfels Bros. produced crushed limestone aggregate from a quarry near Mathis. Building and paving sand and gravel were produced during the year by Thorstenberg Materials Co. and The Fordyce Co.

Schleicher.—All mineral fuels reported increased production. Plant No. 23, Hulldale field, of Sinclair Oil & Gas Co. recovered natural gas liquids. A new pay was discovered at the Flying Anchor gasfield in Midland Basin.

Scurry.—The county ranked fourth in oil production and fifth in total mineral value. Kelly-Snyder oilfield produced 15.2 million barrels of crude oil and Diamond M, 5.6 million barrels. Four gasoline plants with a combined capacity of 130 million cubic feet daily recovered natural gas liquids from Cogdell, Kelly-Snyder, and Sharon Ridge fields. Southwestern Brick & Tile Co. mined shale for manufacturing brick and heavy clay products.

Shackelford.—A 2 percent decrease in mineral value was reported. The discovery of several new oilfields indicated the considerable interest shown in the area by oil and gas companies. Natural gas liquids were recovered at Cook No. 1 gasoline plant of Marshall R.

Young Drilling Co. Leuders Limestone Co. prepared rough and dressed architectural limestone.

Sherman.—The Sherman helium plant of Phillips Petroleum Co. began production on the last day of 1962. The first crude helium from the plant, which was under the Federal conservation program, was stored.

Smith.—A county landmark, the Chapel Hill plant of Lone Star Producing Co., was shut down and dismantling processes were begun. Clay was mined from open pits by Reliance Clay Products Co. H. J. Ellis Sand Co. prepared industrial sand and gravel. Crude oil was refined at the Tyler refinery of LaGloria Oil & Gas Co.

Starr.—Increased production of mineral fuels accounted for the 6 percent rise in total mineral value. Natural gas liquids were recovered at two gasoline plants and one cycling plant. Clark Fuel Producing Co. built a 3-million-cubic-foot-per-day plant to recover natural gas liquids in South Kelsey field. Building and paving sand were produced by The Fordyce Co. Pozzolana, Inc., mined pumicite (volcanic ash) from open pits near Rio Grande.

Stephens.—Combined losses in mineral fuels output were responsible for the 10 percent decline in mineral value. Five gasoline plants, with a combined daily capacity of 42 million cubic feet, recovered natural gas liquids. Taylor Bros. produced building sand and gravel. Contractors quarried and prepared limestone for aggregate and riprap for District 23 of the Texas Highway Department.

Tarrant.—Significant increases in output occurred for all minerals produced, increasing total mineral value by 30 percent. Tarrant County ranked third in sand and gravel production. Portland and masonry cements were produced at the Fort Worth plant of Trinity Division of General Portland Cement Co. Crushed limestone was produced by various producers for highway aggregate. Eleven sand and gravel plants operated by seven companies produced 1.9 million tons of prepared sand and gravel for building and paving.

Taylor.—Over 38,000 barrels of crude oil was produced in a field discovered in 1962. Schafer, W.-Fry, Upper field reported 38° gravity oil production from 4,400 feet. Crude oil was refined at the Abilene refinery of Debco Corporation of Texas. Shale was mined from open pits by Abilene Brick Co. Building and paving sand and gravel were prepared by Atlas Sand & Gravel Co., R. E. Janes Gravel Co., Inc., and Caton Sand & Gravel. H. B. Zachry Co. quarried and crushed limestone for aggregate and roadstone. Natural gas liquids were recovered at two gasoline plants.

Terry.—Overall value of mineral output gained slightly because of a significant increase in natural saline output which nullified production losses in crude oil and natural gas liquids. Sodium sulfate was recovered from brines at the Brownfield plant of Ozark-Mahoning Co. Furnace carbon black was recovered from distillates at Seagraves No. 64 furnace plant of Columbian Carbon Co. Natural gas liquids were recovered at the Chillgas Corp. Wellman field plant and the Amerada Petroleum Corp. Adair field plant.

Tom Green.—All minerals produced within the county, with the exception of stone, contributed to the 6 percent rise in total mineral value. Building and paving sand and gravel were produced by

Montgomery Sand & Gravel Co. H. B. Zachry Co. and various other producers prepared aggregate and riprap for the Bureau of Reclamation.

Travis.—Marble for terrazzo, whiting, and roofing granules was processed at the Austin mill of Dezendorf Marble Co. from stone originating in Llano and Burnet Counties. High-calcium limestone was quarried and calcined to lime by Austin White Lime Co. Texas Crushed Stone Co. prepared limestone for use as flux in refractories and in agricultural liming. Texas Crushed Stone Co. announced that it would move from its Balcones plant in northwest Austin early in 1963. Travis Materials, Inc., and Capital Aggregates, Inc., produced building and paving sand and gravel. Longhorn Sand & Gravel Corp. began producing sand at its new $250,000 plant on the Colorado River 8 miles east of Austin. The plant had a capacity of 200 to 250 tons per hour.

Upton.—A significant decline in natural gas liquid output more than offset increased crude oil and natural gas production to account for the 4 percent decline in total mineral value. Wilshire (Ellenburger) oilfield produced 1.1 million barrels of crude oil; Spraberry Trend area that extends into Reagan County produced 4.4 million barrels; McCamey oilfield produced 2.1 million barrels; and Pegasus field extending into Midland County produced 3.1 million barrels. Five gasoline plants with a combined daily capacity of 175 million cubic feet recovered natural gas liquids. Shell Oil Co. will build a 20-million-cubic-foot-per-day gas processing plant near McCamey.

Uvalde.—Three companies produced asphaltic limestone and basalt. Natural asphalt was used for road repairing and surfacing and basalt for concrete aggregate and roadstone. D & D Gravel Co. produced building and paving sand and gravel. A limited quantity of natural gas was reported.

Van Zandt.—Morton Salt Co. recovered salt in brine from wells and mined salt underground. Pure Oil Co. recovered natural gas liquids at its Van gasoline plant. A new gas condensate field was discovered at 12,700 feet. Northeast Edgewood (Smackover) field was reported to have good reserves.

Victoria.—The mineral economy centered around the mineral fuels industry and production of sand and gravel. Increased output of oil and sand and gravel accounted for the 6 percent increase in total mineral value. An ammonia plant was being added to the E. I. du Pont de Nemours Co., Inc., Victoria petrochemical plant. Building and paving sand and gravel were produced by Heldenfels Bros., The Fordyce Co., and Thorstenberg Materials Co. Three gasoline plants recovered natural gas liquids.

Waller.—Increased production was reported for all minerals. Most of the increase in value was attributable to greater output in mineral fuels. The Katy cycling plant of Humble Oil & Refining Co. recovered natural gas liquids.

Ward.—All eight minerals and mineral fuels produced within the county, except one, were reported to have increased production. Value of petroleum produced increased almost $4 million. The following fields produced over 1 million barrels of crude: Ward-Estes North field—18.8 million barrels; Ward South field—2.3 million bar-

rels; and Shipley Queensand field—1.6 million barrels. Three gasoline plants recovered natural gas liquids from North Ward and North Ward Estes fields. Ozark-Mahoning Co. prepared salt cake from brine and dry salt beds at its Monahans plant. Building and paving sand and gravel were prepared by Permian Sand & Gravel Co. and F. M. Reeves & Sons, Inc.

Webb.—Phillips Petroleum Co. completed its Freer gasoline plant and the resulting production accounted for the 26 percent increase in total mineral value recorded for 1962. Smelter operations at the Laredo smelter of National Lead Co. continued at about the same rate as in 1961 with Commodity Credit Corp. barter program for grain and agricultural products supplying most of the Mexican antimony ore. Building gravel was prepared by three producers.

Wharton.—Reduced output of petroleum and sulfur was responsible for the slight decrease in mineral value. Sulfur was recovered by the Frasch process at Boling Dome of Texas Gulf Sulphur Co. An increasing amount of sulfur was shipped in molten form via special rail cars to Texas Gulf transportation facilities at Beaumont. Natural gas liquids were recovered at the West Bernard gasoline plant of Tidewater Oil Co.

Wheeler.—The mineral industry centered on mineral fuels production. Decreased output of natural gas and petroleum accounted for the 2 percent drop in total value. United Carbon Co., Inc., recovered carbon black from natural gas distillates at its Shamrock furnace plant. Natural gas liquids were recovered at the McLean–28 gasoline plant of Warren Petroleum Corp.

Wichita.—The 4 percent decline in mineral value occurred primarily because of reduced output of petroleum and stone. Crude oil was refined in Wichita Falls by Continental Oil Co. and American Petrofina Co. Gasoline plants of Continental Oil Co. (KMA); Socony Oil Co., Inc. (Burkburnett); and Texaco, Inc. (Electra) recovered natural gas liquids. Wichita Sand & Gravel Co., Inc., and Northwest Materials Co. prepared building and paving sand and gravel. Texas Highway Department had sandstone quarried and prepared for aggregate and roadstone.

Wilbarger.—Wilbarger County field produced 4.0 million barrels of crude oil. Contractors quarried and prepared sandstone for the Texas Highway Department.

Willacy.—Pan American Petroleum Corp. built a refrigeration-absorption gasoline plant in the La Sal Vieja field. The plant was to have a daily capacity of 11.5 million cubic feet. It was expected to recover about 1,400 gallons of liquid per day.

Williamson.—Round Rock White Lime Co. and White Stone & Lime Co. quarried and crushed high-calcium limestone to manufacture quicklime and hydrated lime for building, chemical, and industrial uses. Dimension limestone for building was quarried and processed by Leander Limestone Corp. Crushed limestone was quarried and crushed by Texas Crushed Stone Co., and Texas Carbonate Co.

Winkler.—The important fields and their production in millions of barrels of crude oil were as follows: Embar—1.4; Hendrick—1.5; Kermit—4.3; Keystone Colby Fan—1.6; Keystone Ellen Fan—2.2; Scarborro—2.2; and Ward Estes, North—18.8. Eight gasoline plants

with a total capacity of 217 million cubic feet daily recovered natural gas liquids. Perry R. Bass Co. completed a new gas processing plant at Kermit. The $1.5 million plant would produce butane, propane, and natural gas.

Wise.—Increased production of natural gas, natural gas liquids, and stone accounted for the 6 percent increase in total mineral value. Natural gas liquids were recovered in three gasoline plants, having a combined daily capacity of 2.8 million cubic feet. Shale was mined from open pits by Acme Brick Co. Bridgeport Stone Co., Gifford-Hill & Co., Inc., Southwest Stone Co., and Wesco Materials Corp. quarried and crushed 3.6 million tons of limestone. Contractors produced crushed limestone for District 2 of the Texas Highway Department.

Wood.—Pan American Petroleum Corp. began constructing a 31-million-cubic-foot-per-day gasoline plant in West Yantis field which would be completed in the spring of 1963. The recovery of 5,000 barrels of stabilized distillate and 72 long tons of sulfur was expected. Natural gas liquids were recovered at gasoline plants of Humble Oil & Refining Co. and Caska Corp.

Yoakum.—Mineral industry activity centered in crude oil, natural gas, and natural gas liquids industries and significant quantities of salt were also produced. Prentice oilfield produced 1.4 million barrels of crude oil and Prentice-6,700 field produced 1.7 million barrels. Natural gas liquids were recovered at the Wasson gasoline plant of Shell Oil Co. and the Prentice plant of Pan American Petroleum Corp. These plants had a combined daily capacity of 165 million cubic feet. Frontier Chemical Co. recovered salt from wells until April when the plant was shut down and dismantled.

Young.—Young County Regular field produced 2.7 million barrels of crude oil. Natural gas liquids were recovered at three gasoline plants. Contractors prepared sandstone for the Texas Highway Department. Pitcock Brothers prepared sand and gravel.

The Mineral Industry of Utah

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Utah Geological and Mineralogical Survey for collecting information on all minerals except fuels.

By M. H. Howes [1]

MINERAL-production value for Utah in 1962 was $410 million, a decline of $6.4 million (2 percent) under that of 1961. Of this total, metals value accounted for $224.8 million (55 percent), mineral fuels $137.5 million (33 percent), and nonmetals $48.1 million (12 percent). An increase in value of $6.5 million for nonmetals was offset by decreases in values of $6.2 million for metals and $6.7 million for mineral fuels.

A gain of 5 percent in the output value of copper, the leading mineral product in Utah accounting for 33 percent of the total mineral-production value in the State, plus gains in values of silver and vanadium were more than offset by declines in values of iron ore, uranium ore, lead, gold, zinc, and molybdenum; metals value as a whole declined 3 percent below that of 1961.

A 5-percent drop in the total value of mineral fuels was caused by decreases in production values of coal and petroleum. Most of the decrease in coal value was borne by companies whose products were used in manufacturing steel. Continued reservoir-pressure drops contributed to a lower petroleum output in the Greater Aneth area, from which 71 percent of the State production came. The value of asphalt, carbon dioxide, natural gas, and natural gas liquids increased.

Forty-four percent of the value of nonmetals was provided by sand and gravel, which rose $3.98 million, accounting for a part of the 16-percent increase in the total nonmetals output value. Values also increased for cement, clays, gem stones, gypsum, lime, phosphate rock, potassium salts, salt, and stone. The only nonmetals to decline in value were barite, fluorspar, perlite, and pumice, all of less productive importance.

Employment and Injuries.—Final employment and injuries data for 1961 and preliminary data for 1962 (excluding all mineral fuels industries except the coal and asphalt industries) compiled by the Federal Bureau of Mines are shown in table 2.

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[1] Mining engineer, Bureau of Mines, Denver, Colo.

TABLE 1.—Mineral production in Utah [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Carbon dioxide, natural thousand cubic feet	78,136	$5	81,920	$6
Clays thousand short tons	143	1,080	174	1,403
Coal (bituminous) do	5,159	31,126	4,297	23,209
Copper (recoverable content of ores, etc.) short tons	213,534	128,120	218,018	134,299
Flourspar do	610	18	399	12
Gem stones		73		75
Gold (recoverable content of ores, etc.) troy ounces	342,988	12,005	311,924	10,917
Iron ore (usable) thousand long tons, gross weight	3,533	25,493	2,630	18,242
Lead (recoverable content of ores, etc.) short tons	40,894	8,424	38,199	7,029
Lime thousand short tons	142	2,626	163	2,759
Natural gas million cubic feet	57,175	8,976	74,128	12,454
Perlite short tons	(2)	(2)	929	3
Petroleum (crude) thousand 42-gallon barrels	33,118	91,075	[4] 30,964	[4] 84,841
Pumice thousand short tons	60	95	28	46
Salt (common) do	249	3,187	311	3,349
Sand and gravel do	[5] 18,325	[5] 16,979	19,941	20,954
Silver (recoverable content of ores, etc.) thousand troy ounces	4,798	4,435	4,628	5,022
Stone thousand short tons	1,808	3,219	2,118	3,865
Uranium ore short tons	1,098,783	25,734	781,955	23,653
Vanadium do	514	(3)	525	(3)
Zinc (recoverable content of ores, etc.) do	37,239	8,565	34,313	7,892
Value of items that cannot be disclosed: Asphalt and related bitumens, barite, cement, gypsum, molybdenum, natural gas liquids, phosphate rock, potassium salts, and values indicated by footnote 3		[6] 45,554		[7] 50,382
Total		[5] 416,789		410,412

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Preliminary figure.
[5] Revised figure.
[6] Value of metals and mineral fuels, $31,253,000; value of nonmetals, $14,301,000.
[7] Value of metals and mineral fuels, $34,749,000; value of nonmetals, $15,633,000.

Legislation and Government Programs.—No contracts were awarded in Utah by the Office of Minerals Exploration (OME) in 1962. The status of active OME contracts, executed in previous years, was as follows: United Park City Mines Co. operated under its contract, to explore for lead and zinc in Salt Lake, Summit, and Wasatch Counties, to September 1, 1962, when the contract was recessed; the operation under the Keystone Mining Co. contract, to explore for lead and zinc in Summit County, recessed from June 30, 1961, to July 1, 1962, was resumed from July 1, 1962, to November 17, 1962, and recessed on November 17, 1962, for the duration of the winter; and the Glen L. Larsen contract, to explore for lead, silver, and copper in Juab and Utah Counties, was in force throughout the year.

Large quantities of sand and gravel and stone were used in contracting interstate, State, and county highways in Utah by the Bureau of Public Roads, the Utah State Department of Highways, and county highway departments. A report [2] showed that from July 1, 1956, to December 31, 1962, Utah completed to full or acceptable interstate highway standards 72.9 miles of road plus 26.7 miles of highways adequate for present travel, for a total of 99.6 miles open to traffic. The State was ranked 40th in total miles open to traffic and 16th

[2] Bureau of Public Roads. Quarterly Report on the Federal-Aid Highway Program. Dec. 31, 1962. Press release BPR 63–10, Feb. 10, 1963.

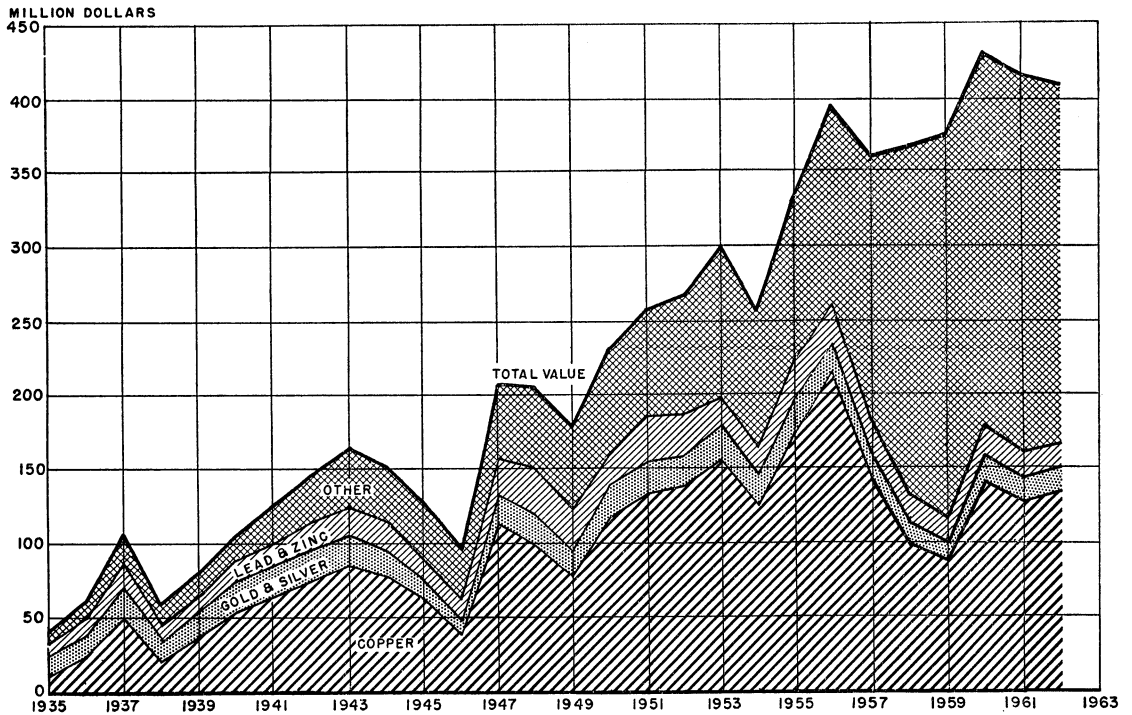

FIGURE 1.—Value of gold, silver, copper, lead, and zinc, and total value of all minerals in Utah, 1935–62.

TABLE 2.—Employment and injuries in the mineral industries [1]

Industry	Number of operations	Average number of men employed	Total man-hours worked	Injuries		Frequency rate (injuries per million man-hours)
				Fatal	Non-fatal	
1961:						
Nonferrous mines, mills and smelter (excluding uranium)	74	7,143	15,233,198	1	209	13.8
Uranium mines and mills	193	1,098	1,960,949	2	93	48.4
Ferrous mines and mills	11	387	729,944		2	2.7
Sand and gravel plants	104	652	1,178,933		21	17.8
Stone quarries and plants	59	394	795,782	1	7	10.1
Nonmetal mines and mills (other than sand and gravel and stone)	65	578	1,087,357	2	84	79.1
Coal (including cleaning plant), asphalt and related bitumens, and coke	53	2,651	4,611,059	[2] 5	141	31.7
Total	559	12,903	25,597,222	11	557	22.2
1962: [3]						
Nonferrous mines, mills and smelter (excluding uranium)	47	4,190	10,286,216	2	127	12.5
Uranium mines and mills	143	1,016	1,710.234	3	61	37.4
Ferrous mines and mills	11	315	620,213		7	11.3
Sand and gravel plants	119	1,021	1,817,374	1	22	12.7
Stone quarries and plants	16	63	828,014		16	19.3
Nonmetal mines and mills (other than sand and gravel and stone)	47	473	989,004	2	105	108.2
Coal (including cleaning plant), asphalt and related bitumens, and coke	50	2,477	3,802,758	2	95	25.5
Total	433	9,555	20,053,813	10	433	22.1

[1] Excludes employees in all mineral fuels industries except the coal and asphalt industries as well as officeworkers.
[2] Revised figure.
[3] Preliminary figures.

in total miles (349.8) of highway in progress. A total of $22.9 million was awarded for Utah highway construction plans [3] in 1962: $3.9 million for State-financed road contracts, $8.1 million for Federal-Aid Primary and Secondary (ABC) contracts, and $10.9 million for interstate contracts. The 1963 plans called for $2 million for State-financed roads, $11 million for ABC contracts, and $60 million for interstate contracts, a 219-percent increase in aggregate highway-construction expenditures.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—Exploratory drilling for and development of beryllium ores in the Spor Mountain area, northwest of Delta, were conducted throughout the year. The Anaconda Company in its 1962 annual report stated that investigation and drill development led to discovering additional beryllium ores in properties of Topaz Beryllium Co., a consolidated subsidiary of Anaconda. In addition, the company entry into the beryllium industry reportedly was being accelerated by the addition of a metallurgical and fabricating plant and an experienced staff.

[3] Engineering News-Record. Road Contractors Will Set a Record. V. 170, No. 16, Apr. 18, 1963. pp. 21–24.

Tests on Spor Mountain beryllium ore, by a solvent-extraction process, were conducted in a 10-ton-per-day pilot plant by Vitro Chemical Co. Division, Vitro Corporation of America, at Salt Lake City. High-purity beryllium oxide was obtained by calcining beryllium hydroxide produced by the process. Gavin H. Young, general manager of Vitro Minerals Corp., reported [4] that the Spor Mountain district contained about 3 million pounds of recoverable beryllium metal.

In October, The Brush Beryllium Co. acquired ownership of Beryllium Resources, Inc.,[5] holder of substantial beryllium-ore deposits in the Spor Mountain area.

Copper.—Copper continued to be the leading commodity in value of mineral production; Utah again was second only to Arizona in the output of copper. Although production was 2 percent larger, the increase of 0.8 cent per pound in the weighted average price for copper in 1962—to 30.8 cents—resulted in a 5-percent gain in the output value. The Utah Copper Division operation of Kennecott Copper Corp. was by far the largest producer in the State; the United States Smelting Refining and Mining Co. (USSR&M Co.) U.S. and Lark mine operation was second. Other major copper producers were McFarland & Hullinger, lessees of USSR&M Co. Ophir mine, and United Park City Mines Co., United Park City mine.

TABLE 3.—Mine production of gold, silver, copper, lead, and zinc in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1953–57 (average)	68	----	29,816	424,501	$14,858	6,385	$5,779
1958	61	2	24,871	307,824	10,774	5,278	4,777
1959	30	----	20,221	239,517	8,383	3,734	3,380
1960	37	----	28,832	368,255	12,889	4,783	4,329
1961	34	----	28,542	342,988	12,005	4,798	4,435
1962	25	----	29,981	311,924	10,917	4,628	5,022
1864–1962	[3]	[3]	[4] 1,025,338	16,765,408	487,015	818,458	614,871

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	240,548	$161,931	46,194	$13,303	37,998	$9,173	$205,044
1958	189,184	99,511	40,355	9,443	44,982	9,176	133,681
1959	144,715	88,855	36,630	8,425	35,223	8,101	117,144
1960	218,049	139,987	39,398	9,219	35,476	9,153	175,577
1961	213,534	128,120	40,894	8,424	37,239	8,565	161,549
1962	218,018	134,299	38,199	7,029	34,313	7,892	165,159
1864–1962	8,610,077	3,445,035	5,149,622	695,133	1,585,010	290,841	5,532,895

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings, or slimes re-treated; and ore, old tailings, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Data not available.
[4] Figures estimated for certain years before 1901.

[4] Utah Beryllium in U.S. Space Program? Intermountain Industry, July 1962, p. 8.
[5] The Brush Beryllium Co. 1962, Thirty-second Annual Report.

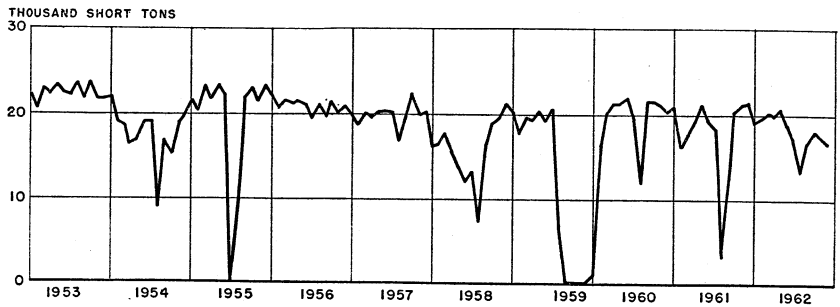

FIGURE 2.—Mine production of copper in Utah, 1953–62, by months, in terms of recoverable metals.

TABLE 4.—Mine production of gold, silver, copper, lead, and zinc in 1962, by counties, in terms of recoverable metals

County	Mines producing [1] (lode)	Lode material sold or treated [2] (short tons)	Gold		Silver	
			Troy ounces	Value	Troy ounces	Value
Beaver	[3] 3	[3] 11,808	[3] 131	[3] $4,585	[3] 14,446	[3] $15,674
Box Elder	1	2			21	23
Emery					2	2
Millard	1	94			44	48
Piute	2	1,209	72	2,520	9,065	9,836
Salt Lake	7	29,690,297	307,975	10,779,125	3,617,518	3,925,008
San Juan	(3)	(3)	(3)	(3)	(3)	(3)
Sanpete	1	21			29	31
Summit	3	226,013	2,363	82,705	689,532	748,142
Tooele	5	31,252	145	5,075	225,463	244,627
Wasatch	2	19,771	1,238	43,330	72,234	78,374
Washington		37			92	100
Total:						
1962	25	29,980,504	311,924	10,917,340	4,628,446	5,021,865
1961	34	28,542,057	342,988	12,004,580	4,797,583	4,435,318

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Beaver	[3] 519	[3] $319,704	[3] 2	[3] $405	[3] 93	[3] $21,355	[3] $361,723
Box Elder			(4)	9			32
Emery	(4)	62					64
Millard					13	3,024	3,072
Piute	3	1,601	49	8,997	57	13,087	36,041
Salt Lake	216,959	133,647,114	29,444	5,417,668	24,424	5,617,428	159,386,343
San Juan	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Sanpete			1	129	1	242	402
Summit	227	139,955	5,396	992,855	6,783	1,560,090	3,523,747
Tooele	259	159,667	2,429	447,019	1,775	408,238	1,264,626
Wasatch	45	27,443	878	161,534	1,167	268,514	579,195
Washington	6	3,542			(4)	12	3,654
Total:							
1962	218,018	134,299,088	38,199	7,028,616	34,313	7,891,990	165,158,899
1961	213,534	128,120,400	40,894	8,424,164	37,239	8,564,970	161,549,432

[1] Operations at slag dumps and old mill or miscellaneous cleanups not counted as producing mines; various uranium mines from which copper was recovered as a byproduct not included as they were in the mine count of uranium.
[2] Excludes tonnage of copper precipitates shipped.
[3] Production of Beaver and San Juan Counties combined to avoid disclosing individual company confidential data.
[4] Less than 0.5 ton.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold-silver	2	145,123	735	16,137	1,558,800	67,600	19,600
Dry silver	7	137,555	1,335	216,843	241,400	20,100	23,000
Total	9	282,678	2,070	232,980	1,800,200	87,700	42,600
Copper, copper-lead, and uranium [2]	[3] 3	[4] 29,181,416	298,988	2,421,575	398,148,000	200	3,500
Copper-zinc	1	5,345	107	3,425	55,500		177,900
Lead	1	1		11		900	
Lead-zinc	14	453,063	10,682	1,953,077	3,241,300	75,046,200	60,862,900
Zinc	2	254	1	1,076	2,200	15,400	79,300
Total	21	29,640,079	309,778	4,379,164	401,447,000	75,062,700	61,123,600
Other lode material:							
Gold mill cleanup	[5]	3	1	1			
Copper cleanup	[5]	41	20	103	12,500		100
Copper precipitates	2	20,435			32,692,400		
Copper-lead-zinc cleanup	[5]	4	15	362	500	1,000	700
Lead cleanup	[5]	3	1	9		2,100	
Lead-zinc cleanup and zinc slag [2]	[5]	57,696	39	15,827	83,400	1,244,500	7,459,000
Total	2	78,182	76	16,302	32,788,800	1,247,600	7,459,800
Total lode material	32	30,000,939	311,924	4,628,446	436,036,000	76,398,000	68,626,000

[1] Detail will not necessarily add to totals because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Copper and copper-lead mines only; excludes the mine count of uranium mines from which copper was recovered as a byproduct.
[4] Excludes uranium-ore tonnage.
[5] From properties not classed as mines.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1962, by types of material processed and methods of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Concentration, and smelting of concentrates:					
Ore [1]	309,760	4,350,596	401,379,900	74,632,200	60,715,000
Cleanings	9	832	400	16,700	27,700
Total	309,769	4,351,428	401,380,300	74,648,900	60,742,700
Direct-smelting:					
Ore	2,088	261,548	1,867,300	518,200	451,200
Copper precipitates			32,692,400		
Cleanings and old slag	67	15,470	96,000	1,230,900	7,432,100
Total	2,155	277,018	34,655,700	1,749,100	7,883,300
Grand total	311,924	4,628,446	436,036,000	76,398,000	68,626,000

[1] Includes uranium-ore concentrate.

In its 1962 annual report, Kennecott Copper Corp. announced that the board of directors had approved a plan, costing approximately $100 million, to increase the productive capacity of the Utah Copper Division from 200,000 to about 300,000 tons of copper per year. The program was to be completed in 4 to 5 years.

Utah Copper Division of Kennecott moved more than 102 million tons of ore and waste from the Utah Copper open pit in 1962, thus establishing a world record for material moved by a single mining operation in a calendar year. It also established a new world daily mining record of 283,873 tons of combined ore and waste.

USSR&M Co. concluded an agreement in September with Kennecott under which Kennecott acquired surface rights to 7,400 acres of land adjacent to the Utah Copper pit; was granted a 10-year lease to extract material other than lead-zinc ores at the U.S. and Lark properties; and was given an option to purchase the leased premises at the expiration of the lease, except for lead-zinc ores and certain surface facilities, both of which may be acquired outright not later than 1992 by the exercise of another option.

Gold.—A 9-percent drop in gold-production value was largely caused by a lower gold content in the copper ore mined from the Kennecott Utah Copper pit, source of most of the State gold output. Other major producers were USSR&M Co. at the U.S. and Lark mine, Hecla Mining Co. at the Mayflower mine, and United Park City Mines Co. at the United Park City mine. Under a contract with New Park Mining Co., Hecla Mining Co. operated the Mayflower mine at Keetley; deepened the No. 1 shaft 400 feet to the 2,400-foot level; conducted exploration and development work on the 2,400-foot level; and, north of the Mayflower adit portal, constructed a 400-ton-per-day concentrator, which began operating in December.

Iron Ore.—The quantity of iron ore (usable) shipped was 903,000 long tons less and the value was $7.3 million lower than in 1961. All of the iron ore was produced in Iron County by Columbia Iron Mining Co., subsidiary of United States Steel Corp., at the Desert Mound and Iron Mountain mines; by Utah Construction & Mining Co. at the Iron Springs mine; and by The Colorado Fuel and Iron Corp. (CF&I) at the Blowout, Comstock, and Duncan mines (mined under contract by Utah Construction & Mining Co.). All of the ore from the Desert Mound and Iron Mountain mines and most of the ore and concentrate shipped from the Iron Springs operation were processed at Columbia-Geneva Steel Division of United States Steel Corp. Geneva and Ironton plants. A small quantity of the ore from the Iron Springs mine was used in the cement industry. Ore from the Blowout, Comstock, and Duncan mines was shipped to the CF&I plant at Pueblo, Colo.

TABLE 7.—Usable iron ore shipments
(Thousand long tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	3,933	$25,671	1961	3,533	$25,493
1958	3,514	25,202	1962	2,630	18,242
1959	2,842	19,979			
1960	3,334	23,862	1906–62	66,661	300,510

Lead.—Production of lead declined 7 percent in quantity and 17 percent in value in 1962. The decline in value was greater than the decline in output because the 1962 weighted average price for lead was 1.1 cents per pound less than that of 1961. Utah was ranked third in lead production for the Nation, following Idaho and Missouri. USSR&M Co. at its U.S. and Lark mine (one of the major lead-zinc producers in the world) accounted for most of the lead output in the State. Other major production came from the United Park City mine (United Park City Mines Co.); Ophir mine of USSR&M Co. (McFarland & Hullinger, lessees); Keystone mine (Keystone Mining Co. and United Park City Mines Co., joint venture); Murray slag dump (International Smelting and Refining Co.); Mayflower mine (Hecla Mining Co.); and Cardiff, Hirshman Estate, and Kennebec mines (Beeson Exploration and Grand Deposit Mining Co.).

According to a USSR&M Co. official, the company development program to reach the downward projections of ore shoots in the Kennecott-Butterfield lead-zinc mine by USSR&M Co. through its U.S. and Lark mine was continued. Expectations were that ore objectives should be reached in 1963.

Kennecott and its subsidiary, Bear Creek Mining Co., continued to develop and explore for ore in the Burgin-shaft area in the East Tintic district. At the end of the year progress was being made on the rehabilitation of the adjacent Apex shaft to provide the ventilation connection and second opening necessary for further work. Tintic Mining Division was organized by Kennecott to initiate, early in 1963, production of direct smelting ore from the Burgin mine.

Molybdenum.—The entire production of molybdenum continued to be recovered as a byproduct of copper ore mined from the Kennecott Utah Copper pit. Molybdenum was recovered as a molybdenite concentrate by flotation of the copper concentrates at the company mills. An 8-percent decrease in the output of molybdenum resulted because the ore mined had a lower molybdenum content.

Silver.—The advance of 16 cents per ounce in the 1962 weighted average price of silver, compared with the 1961 price, increased the production value 13 percent, even though the output decreased 4 percent. One-half of the silver produced came from the Utah Copper mine. The USSR&M Co. operation at U.S. and Lark mine was the second largest producer. Other producers, each with an output of 20,000 ounces or more, were United Park City Mines Co. at the United Park City mine; McFarland & Hullinger, lessees, at the USSR&M Co. Ophir mine, and at the Ontario dump; Wortley Co. at the Daly West dump; Beeson Exploration and Grand Deposit Mining Co. at the Cardiff, Hirshman Estate, and Kennebec mines; Hecla Mining Co. at the Mayflower mine; and Keystone Mining Co. and United Park City Mines Co. (joint venture) at the Keystone mine.

Uranium Ore.—Uranium ore dropped 29 percent in tonnage mined and 11 percent in pounds of contained U_3O_8 produced. However, a decrease of only 8 percent in value of ore produced was due to a rise in average grade from 0.28 percent in 1961 to 0.35 percent in 1962. A total of 240 operations were active in eight counties compared with 307 operations in nine counties in 1961. Eighty-seven percent of the production came from San Juan County.

Three uranium processing plants were operated throughout the year: Vitro Chemical Co., Salt Lake City; Texas-Zinc Minerals Corp., Mexican Hat; and Uranium Reduction Co., Moab. The last-named company was merged with Atlas Minerals Division, Atlas Corp., in midyear.

TABLE 8.—Mine production of uranium ore, by counties [1]

County	1961				1962			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]
Beaver	1	(3)	(3)	(3)	2	(3)	(3)	(3)
Emery	33	89,285	424,472	$1,740,667	25	33,306	163,847	$672,854
Garfield	39	1,103	14,695	67,713	33	2,927	20,553	88,589
Grand	59	32,375	171,327	701,551	40	23,815	131,675	545,691
Juab	1	(3)	(3)	(3)	1	22,002	99,808	414,738
Piute	7	(3)	(3)	(3)	8	(3)	(3)	(3)
San Juan	163	917,558	5,351,951	22,451,157	130	678,897	5,000,163	21,654,106
Wayne	4	923	6,239	26,462	1	26	62	150
Undistributed	-------	57,539	207,426	746,665	-------	20,982	75,898	276,726
Total	307	1,098,783	6,176,110	25,734,215	240	781,955	5,492,006	23,652,854

[1] Receipts at mills based on data supplied to the Bureau of Mines by AEC.
[2] F.o.b. mine value; base price, grade premiums, and exploration allowance.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

The holdings of the Uranium Reduction Co. and the Utex Exploration Co. Mi Vida mine were purchased by Atlas Corp., which established the Atlas Minerals Division to manage the company mineral interests effective in midyear.

Vanadium.—Vanadium-bearing uranium ores, mined in Emery, Garfield, Grand, San Juan, and Wayne Counties, were credited to Utah, but were processed at mills in southwestern Colorado and northwestern New Mexico—American Metal Climax, Inc., Climax Division, Climax Uranium Co., Grand Junction, Colo.; Union Carbide Corp., Union Carbide Nuclear Co. Division, Rifle and Uravan, Colo.; Vanadium Corporation of America (VCA), Durango and Naturita, Colo.; and Kerr-McGee Oil Industries, Inc., Shiprock, N. Mex. The output of vanadium, recovered from Utah uranium ores, was 2 percent more than in 1961.

Zinc.—Both quantity and value of zinc production declined 8 percent below those of 1961. Utah was ranked sixth in zinc output in the Nation. USSR&M Co. at the U.S. and Lark mine contributed over one-half of the total production in the State. Other producers of substantial quantities, in order of output, were United Park City Mines Co. at the United Park City mine; International Smelting and Refining Co. at the Murray slag dump; McFarland & Hullinger, lessees at the USSR&M Co. Ophir unit; and Hecla Mining Co. at the Mayflower mine.

MINERAL FUELS

Asphalt and Related Bitumens.—Production of gilsonite (uintahite) increased in quantity and value over that of 1961. American Gilsonite Co., the major producer, at the Bonanza mines, and Ziegler Chemical & Mineral Corp. (formerly G. S. Ziegler & Co.) at Little Bonanza, both in Uintah County, accounted for the entire output.

A 72-mile-long, 6-inch-diameter gilsonite-slurry pipeline between the American Gilsonite mines at Bonanza and the company refinery at Fruita, Colo., (near Grand Junction) was operated successfully in 1962 as it had since it was placed in use in April 1957.[6] The cost per ton-mile of transporting gilsonite by pipeline in the quantity of 1,100 tons per day, during the entire operating period, was $0.0139, according to the company.

Carbon Dioxide.—Carbon dioxide collected from wells at Farnham Dome field in Carbon County and transported by pipeline to a plant at Wellington for conversion into dry ice and liquid carbon dioxide increased 5 percent in quantity and 20 percent in value over those for 1961.

Construction of the Sinclair Oil & Gas Co. 20-million-cubic-foot-per-day carbon dioxide removal plant near Cisco was to be completed in the spring of 1963.

Coal (Bituminous).—Tonnage of coal mined was 17 percent less than in 1961, and a drop in the average value per ton from $6.03 in 1961 to $5.40 in 1962 caused a 25-percent decrease in output value. Production came from 38 mines in 5 counties compared with 40 mines in 5 counties in 1961. Carbon and Emery Counties contributed 72 and 25 percent, respectively, of the State total of 4.3 million tons mined. Leading producers were Kaiser Steel Corp. at Sunnyside Nos. 1, 2, and 3 mines; United States Steel Corp. at Columbia and Geneva mines; Independent Coal & Coke Co. at Castle Gate No. 4, Clear Creek No. 3, Kenilworth, and O'Connor No. 2 mines; and United States Fuel Co. at Kingmine.

TABLE 9.—Coal (bituminous) production, by counties

(Excludes mines producing less than 1,000 short tons)

County	1961		1962	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Carbon	3,915,881	$6.16	3,105,127	$5.64
Emery	1,123,885	5.68	1,077,249	4.71
Iron	52,255	4.94	45,742	4.72
Sevier	47,343	6.13	49,393	6.29
Summit	19,881	4.39	19,509	4.46
Total	5,159,245	6.03	4,297,020	5.40

[1] Value received or charged for coal f.o.b. mine, including selling cost. (Includes value for coal not sold but used by producers, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

[6] Moseley, T. C. Hydraulic Transportation of Gilsonite Solids. Min. Cong. J., v. 48, No. 8, August 1962, pp. 79–83.

The University of Utah was awarded a contract by the Office of Coal Research, U.S. Department of the Interior, to conduct a 3-year research program on five processes for upgrading western coals. The Government was to contribute $150,000 and the State $102,397 for the project.

Natural Gas.—Marketed natural gas production increased 30 percent in quantity and 39 percent in value. Natural gas was produced in seven counties; San Juan and Uintah accounted for 81 percent of the total output. In addition to the successful completion of 41 development wells (1 each in Duchesne and Emery Counties, 11 in Grand, and 28 in Uintah), discovery of gas in new fields was made in 9 wildcat wells (3 in Grand County and 6 in Uintah).

Natural Gas Liquids.—The quantity of natural gasoline production increased 11 percent, and liquefied petroleum gases (butane and propane) output decreased 3 percent, whereas the output value of these two classes of commodities increased 144 and 40 percent, respectively. Recovery of natural gas liquids was made at three natural gas processing plants: El Paso Natural Gas Co. in Aneth field, San Juan County; California Oil Co., Western Division, in Red Wash field, Uintah County; and Mountain Fuel Supply Co. in Clay Basin field, Daggett County. Liquids recovered from the Aneth plant were processed at the company fractionation plant at Wingate, N. Mex.

Petroleum.—Output of crude petroleum, 31 million barrels from 852 wells in 7 counties, dropped 7 percent both in quantity and value below that of 1961. The decline was due to a smaller production in San Juan County from Greater Aneth area, which contributed 70 percent of the State total. The McElmo waterflood project for secondary recovery from the Aneth field was successfully conducted during the year.

Leading petroleum producers, each with an output of over 1 million barrels, in decreasing order of production, were Texaco Inc., Superior Oil Co., California Oil Co., Humble Oil & Refining Co., Phillips Petroleum Co., Shell Oil Co., Continental Oil Co., and Pure Oil Co.

Of 284 well completions, oil was discovered in 92 and gas in 50. Eleven wildcat wells were successful, 1 in Duchesne County, 3 in Grand, 5 in San Juan, and 2 in Uintah.

A total of 30.7 million barrels of crude oil (1.2 percent less than in 1961) was processed at the refineries of American Oil Co. and California Oil Co., Salt Lake City; Beeline Refining Co. Division, Frontier Refining Co., North Salt Lake; and Phillips Petroleum Co., Woods Cross.

TABLE 10.—Crude petroleum production by counties[1]

(Thousand barrels)

County	1961	1962[2]	Principal fields in 1962 in order of production
Carbon		4	Jack Canyon.
Daggett		2	Clay Basin.
Duchesne	8	27	Duchesne.
Emery		33	Grassy Trail.
Grand	54	199	Big Flat, Long Canyon, Salt Wash.
San Juan	27,585	24,959	McElmo, Aneth, Ratherford.
Uintah	5,470	5,740	Red Wash, Ashley Valley.
Washington	1		
Total	33,118	30,964	

[1] Based on Utah Oil & Gas Conservation Commission county data adjusted to Bureau of Mines total.
[2] Preliminary figures.

TABLE 11.—Wildcat- and development-well completions in 1962, by counties

County	Crude	Condensate	Gas	Dry	Service	Total	Footage
Wildcat:							
Carbon				6		6	13,900
Daggett				2		2	9,400
Duchesne	1			3		4	25,300
Emery				12		12	69,500
Garfield				2		2	10,100
Grand	3		3	14		20	123,600
San Juan	5			27		32	198,000
Sevier				1		1	10,700
Uintah	2		6	16		24	154,900
Utah				1		1	3,500
Wasatch				1		1	6,500
Washington				2		2	9,700
Wayne				3		3	20,300
Total	11		9	90		110	655,400
Development:							
Carbon	1			2		3	14,300
Duchesne	3		1	1		5	18,500
Emery	2		1	5		8	15,500
Grand	5		11	15		31	113,200
San Juan	31	3		13	1	48	287,100
Uintah	36		28	14		78	472,900
Washington				1		1	800
Total	78	3	41	51	1	174	922,300
Total all drilling	89	3	50	141	1	284	1,577,700

Source: Oil and Gas Journal.

TABLE 12.—Oil and gas discoveries in 1962

County and field	Well	Operator	Location			Producing formation	Gross producing interval (feet)	Total depth (feet)	Initial production		Date of completion	Remarks [1]
			Section	Township	Range				Barrels oil per day	Mcf gas per day		
Carbon County:												
Wildcat	Texaco-Sharples No. 1 Government-Pickrell.	Texaco Inc	11	12 S.	15 E.	Mesaverde	3,782–4,044	8,450		2,400	Dec. 19	GW
Duchesne County:												
Wildcat	Castle Peak Unit No. 1.	Shamrock Oil & Gas Corp.	24	9 S.	15 E.	Wasatch	3,994–4,728	8,816	127	73	Nov. 20	OW
Eight Mile Flat	Wells Draw Unit No. 1.	Mountain Fuel Supply Co.	8	10 S.	17 E.	do	5,204–5,215	8,200	176		Jan. 9	Do.
Emery County:												
Wildcat	Grassy Trail Creek Unit No. 2.	Cities Service Petroleum Co.	2	16 S.	12 E.	Sinbad	3,894–3,986	4,020	39		Jan. 6	Do.
Grand County:												
Wildcat	Moon Ridge Unit No. 31-15.	Pacific Natural Gas Exploration Co.	15	16 S.	21 E.	Cedar mountain.	10,170–10,240	10,301		48,000	Dec. 18	SIGW
Do	Horse Point Unit No. 1-X.	Tidewater Oil Co	14	16 S.	23 E.	Morrison	7,958–8,112	8,774		1,900	July 4	Do.
Do	Federal-Seagull No. 1	Rip C. Underwood	13	16 S.	24 E.	do	5,886–5,902	6,050		7,900	Jan. 16	GW
Do	East Canyon Federal No. 2.	Shamrock Oil & Gas Corp.	24	16 S.	24 E.	Salt Wash	5,735–6,135	6,280		4,193	June 12	SIGW
Do	Westbit No. 2	Belco Petroleum Corp	9	16 S.	25 E.	Dakota	6,055–6,160	6,153		2,700	Aug. 27	Do.
Do	Segundo Canyon Unit No. 1.	Pacific Natural Gas Exploration Co.	9	17 S.	21 E.	Emery	6,700–6,750	9,742	20		Nov. 5	OW
Do	Bookcliffs Unit No. 3	Gulf Oil Corp	33	18 S.	22 E.	Dakota Sand	5,306–5,330	5,418		2,500	Aug. 20	SIGW
Do	Government Smoot No. 1.	Texaco Inc	17	23 S.	17 E.	Mississippian	8,732–8,738	8,876	263		Apr. 23	OW
San Juan County:												
Wildcat	U.S.A. No. 1	Southern Natural Gas Co.	6	27 S.	20 E.	Cane Creek	5,790–5,890	6,003	280		Feb. 28	Do.
Do	U.S.A. Harris No. 1	Tenneco Oil Co	8	39 S.	21 E.	Akah	5,400–5,408	5,547	240		Sept. 23	Do.
Do	Cottonwood Creek No. A-1.	Alco Oil & Gas Corp	19	39 S.	22 E.	Desert Creek	5,603–5,613	5,836	44		May 4	Do.
Do	Navajo Tribe "AH" No. 1.	Texaco Inc	22	41 S.	22 E.	Akah	5,474–5,483	5,715	40		Dec. 26	Do.
Undesignated	Navajo Tract 125 No. 2.	Humble Oil & Refining Co.	28	41 S.	25 E.	Akah "C"	5,337–5,394	5,435	672		May 14	Do.

Uintah County:													
Wildcat	Stagecoach Unit No. 5	Belco Petroleum Corp.	17	9 S.	22 E.	Wasatch	5,710–6,020	6,192		1,100	Feb. 9	GW
Do.	Stagecoach Unit No. 6	do.	20	9 S.	22 E.	do.	5,330–5,655	5,902		4,900	Jan. 2	Do.
Do.	Sharples-Texaco State No. 1	The Sharples Oil Corp.	36	10 S.	22 E.	Mesaverde	4,857–5,490	5,580		1,000	May 8	Do.
Do.	Government No. 1-8	Shamrock Oil & Gas Corp.	8	11 S.	23 E.	Wasatch	4,020–5,670	5,671		28,080	Sept. 18	Do.
Do.	Government No. 1-1	do.	1	12 S.	21 E.	Mesaverde	5,674–5,715	5,827		1,260	July 12	SIGW
Undesignated	Government No. 1-13	Delhi-Taylor Oil Corp.	13	12 S.	21 E.	Wasatch	3,150–5,546	5,546		2,395	Sept. 11	Do.
Wildcat	Government No. 1-5	Shamrock Oil & Gas Corp.	5	12 S.	22 E.	Mesaverde	5,228–5,555	7,605		17,843	June 4	GW

[1] GW—Gas well; OW—oil well; SIGW—shut-in gas well.

Source: Utah Oil & Gas Conservation Commission.

NONMETALS

Barite.—Output of barite, all produced by D. J. Garrick from Juab County, was approximately two-thirds less than in 1961. In its Salt Lake City plant, Metals Disintegrating Co. of Martin-Marietta Corp. ground crude barite, received from California, Idaho, Nevada, and Utah (D. J. Garrick) for use in well drilling.

Cement.—The 7-percent increase in both quantity and value of cement production was attributed to increased road and building construction. Most of the State output of portland cement was produced by Ideal Cement Co. at the Devil's Slide plant in Morgan County; Portland Cement Co. of Utah continued production at its Salt Lake City plant. A small quantity of masonry cement also was produced at the Devil's Slide plant.

Clays.—Production of clays increased 22 percent in quantity and 30 percent in value over that of 1961. Halloysite, mined by Filtrol Corp. at the Dragon mine in Juab County, although second in tonnage to miscellaneous clay, continued to lead all clays in output value. Azome Utah Mining Co., International Pipe and Ceramics Corp. (a 1962 merger of Gladding, McBean & Co. and Lock Joint Pipe Co.), Interstate Brick Co., R. D. Wadley Clay Co., Loyd R. Stubbs, and Western Fire Clay Co. produced miscellaneous and fire clays for building brick, fire brick, and other clay products. The entire production of bentonite by Bosshardt Bros. and fuller's earth and bentonite by Western Clay & Metals Co. came from pits in Sevier County.

Fluorspar.—Output of fluorspar, valued at 33 percent below that of 1961, came from the Chesley & Black Fluorine Queen mine and Willden Bros. Lost Sheep mine, situated in the Spor Mountain area in Juab County. The entire output, consisting of the metallurgical-grade product, was sold for use in steel plants and in iron foundries.

Gem Stones.—Gem stone material collected, valued at $75,000, increased 3 percent over the value in 1961. Production from 16 counties was led by Garfield County. The value was derived mainly from agate, jasper, obsidian, and petrified wood, and lesser amounts of alabaster, chrysocolla, dinosaur bone, magnetite, onyx, smoky quartz, and variscite.

Gypsum.—Production of crude gypsum, all from open-pit mines in Sevier County, increased 5 percent both in quantity and value over that of 1961. The entire output was produced by Bestwall Gypsum Co. and United States Gypsum Co.; both companies operated wallboard plants at their respective mines near Sigurd.

Lime.—Production of lime gained 15 percent in quantity and 5 percent in value over that of 1961. More than two-thirds of the output came from operations of The Utah Lime and Stone Co. and Utah Marblehead Lime Co. in Tooele County. Other producers were The Amalgamated Sugar Co. in Cache County; Utah-Idaho Sugar Co. in Box Elder and Salt Lake Counties; Kennecott Copper Corp., Utah Copper Division, in Salt Lake County; and Lakeside Lime & Stone Co. in Utah County. Most of the lime was used in the State for chemical and other industrial, refractory, and construction purposes; 30 percent was shipped to California, Colorado, Idaho, Montana, Nevada, Oregon, Washington, Wyoming, and Canada. Hydrated lime was

produced by Lakeside Lime & Stone Co. and The Utah Lime and Stone Co.

Perlite.—Twenty-one percent less perlite was expanded than in 1961. Crude production came from Henry Schoo's operation of the North Pearl Queen mine in Beaver County and was expanded by Acme Lite-Wate Products, Inc., Salt Lake City, for use in building plaster, concrete aggregate, and soil conditioning. Bestwall Gypsum Co. expanded crude perlite from Nevada at its Sigurd plant for use in building plaster.

Phosphate Rock.—Production of phosphate rock from operations of San Francisco Chemical Co. at its Cherokee unit in Rich County and its Vernal unit in Uintah County increased 17 percent in quantity and 19 percent in value over that of 1961. Output from the Cherokee unit was processed and sold at the company Leefe plant at Sage, Wyo.; that from the Vernal unit was processed by Western Phosphates, Inc., Garfield, and sold in Utah for agricultural and industrial purposes.

Potash.—A 9-percent increase in production value of potassium salts, all from the Bonneville, Ltd., Wendover operation, the only producer in the State, resulted from the availability of more brine and an increase in the price of potash. According to the company annual report for the fiscal year ending June 30, 1962, the price increase was 0.5 to 1.0 cent per unit of potassium oxide above the 1961 price. In December, two firms, Standard Magnesium Corp., Tulsa, Okla., and Kern County Land Co., San Francisco, Calif., were competing with offers for purchasing Bonneville's interests at Wendover.

The $30-million potash-facility construction of Texas Gulf Sulphur Co. at Cane Creek, near Moab, was nearly completed at yearend. The 36-mile railroad spur connecting the plant with the main line of Denver & Rio Grande Western Railroad at Brendel was finished in October. The mine shaft, to be bottomed at 2,788 feet, was sunk 2,600 feet by December. Underground development, the potash mill, and other surface facilities were to be completed so that the plant could be operated by mid-1963.

Pumice.—Pumice production dropped more than 50 percent. The material was used as concrete aggregate in manufacturing building blocks and associated products.

Salt.—Although the quantity of salt production increased 25 percent, the value was only 5 percent more than in 1961. Less than 3 percent of the salt was produced by means other than solar evaporation of Great Salt Lake brine. Morton Salt Co. with a salt-evaporation operation in Salt Lake County, was the leading producer, followed in order of output by Solar Salt Co., Leslie Salt Co., and Utah Salt Co. in Tooele County; and Rock Crystal Salt Co. in Box Elder County. Rock-salt mines north of Redmond were operated by Albert Poulson, Sanpete County, and by Poulson Brothers Salt Co., Sevier County, for producing stock-feed salt.

Sand and Gravel.—Production of sand and gravel was 9 percent more in quantity and 23 percent greater in value than in 1961. The gains were due largely to increased road and building construction. Pit operations increased from 103 to 110—8 more for commercial and 1 less for Government-and-contractor pits. The output of 15.8 million tons from Kane, Davis, Utah, Salt Lake, and Daggett Counties,

leading producing counties in decreasing order of production—each with over 1 million tons—was 79 percent of the State production. Of 14.7 million tons of sand and gravel produced for Government-and-contractor purposes, 4.9 million tons was produced in Daggett and Kane Counties for use at the Flaming Gorge Dam and Glen Canyon Dam projects, respectively, 100,000 tons in other building structures, and the remainder in road construction.

TABLE 13.—Sand and gravel production in 1962, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Box Elder	940	$680	Rich	39	$29
Cache	432	341	Salt Lake	2,690	2,369
Carbon	5	13	San Juan	132	71
Daggett	1,116	1,151	Sanpete	294	127
Davis	4,034	3,076	Sevier	63	64
Duchesne	223	188	Summit	249	187
Emery	239	172	Tooele	(1)	(1)
Garfield	6	6	Uintah	403	516
Grand	150	402	Utah	3,896	1,446
Iron	15	16	Wasatch	34	20
Juab	23	17	Washington	90	92
Kane	4,049	9,123	Weber	301	298
Millard	116	136	Undistributed	207	249
Morgan	195	165	Total	19,941	20,954

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Stone.—Value of stone produced gained 20 percent in 1962. Crushed limestone, contributing 76 percent of the total stone output, primarily was used in producing cement and lime and as flux in smelting iron and other metals. Ideal Cement Co. at Devil's Slide, in Morgan County, was the major producer of crushed limestone. Other major producers were Portland Cement Co. of Utah, United States Steel Corp. (Columbia-Geneva Steel Division), The Utah Lime and Stone Co., and Utah Marblehead Lime Co.

Crushed sandstone, next in importance to crushed limestone both in quantity and value of output, was produced for use as riprap by the Bureau of Reclamation in Box Elder, Cache, and Wasatch Counties; for exposed aggregate by Fuller and Associates in Box Elder County; for precast products by Aggregate Supply, Inc., in Salt Lake County; and for refractory stone by General Refractories Co. in Juab County.

Other classes of stone produced were crushed granite for use as riprap by the Bureau of Reclamation in Wasatch County; dimension limestone for use in rough construction and for rubble by Utah Calcium Co., Inc., in Tooele County; crushed marble for use as building chips by Henry Schoo in Beaver County; miscellaneous stone for use as dimension building stone and crushed aggregates by the U.S. Army Corps of Engineers in Davis, Tooele, and Utah Counties; and dimension sandstone for various uses as building stone and flagging by Grant L. Nebeker and Utah Stone & Coal Co. in Iron County, Rocky Mountain Quarries in Summit County, Eugene Tuckett Flagstone Co. and Wilford Hansen in Wasatch County, and Utah Scenic Stone Corp. in Washington County.

TABLE 14.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Construction:				
Building	843	$854	999	$1,115
Paving	274	243	402	400
Railroad ballast			(1)	(2)
Fill	21	10	252	227
Other	20	20	22	18
Industrial:				
Molding	3	10	(3)	(3)
Blast	(1)	(2)	(1)	1
Fire or furnace	20	24		
Engine	1	3	23	44
Total	1,182	1,164	1,698	1,805
Gravel:				
Construction:				
Building	1,296	1,322	1,314	1,459
Paving	5,347	2,245	1,497	966
Railroad ballast	(4)	(4)	19	8
Fill	65	42	402	352
Other	30	25	40	40
Miscellaneous	(4)	(4)	300	299
Total	6,738	3,634	3,572	3,124
Total sand and gravel	7,920	4,798	5,270	4,929
Government-and-contractor operations:				
Sand:				
Building	[5] 1,097	[5] 1,978	1,216	2,508
Paving	15	9	224	121
Fill	1,437	240	7	3
Total	[5] 2,549	[5] 2,227	1,447	2,632
Gravel:				
Building	[5] 4,014	[5] 7,396	3,840	7,574
Paving	2,312	1,999	5,821	4,830
Fill	1,511	537	3,563	989
Other	19	22		
Total	[5] 7,856	[5] 9,954	13,224	13,393
Total sand and gravel	[5] 10,405	[5] 12,181	14,671	16,025
All operations:				
Sand	[5] 3,731	[5] 3,391	3,145	4,437
Gravel	[5] 14,594	[5] 13,588	16,796	16,517
Total	[5] 18,325	[5] 16,979	19,941	20,954

[1] Less than 500 tons.
[2] Less than $500.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Engine sand."
[4] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[5] Revised figure.

TABLE 15.—Stone production in 1962, by counties

County	Short tons	Value	County	Short tons	Value
Beaver	482	$2,674	Summit	796	$53,530
Box Elder	(1)	(1)	Tooele	310,226	949,372
Cache	168,776	305,182	Uintah	5,871	8,807
Davis	8,834	9,717	Utah	(1)	(1)
Iron	425	5,812	Wasatch	166,456	439,787
Juab	(1)	(1)	Washington	21	3,500
Millard	(1)	(1)	Undistributed	1,239,409	1,739,459
Morgan	(1)	(1)			
Salt Lake	217,072	346,688	Total	2,118,368	3,864,528

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 16.—Stone sold or used by producers, by kinds

Year	Granite		Limestone		Marble	
	Short tons	Value	Short tons	Value	Short tons	Value
1958	77,300	$146,100	2,958,000	$3,648,900	----------	----------
1959	1,500	1,500	1,547,600	2,196,400	----------	----------
1960	1,200	1,200	1,702,021	2,921,737	----------	----------
1961	----------	----------	1,621,128	2,815,852	639	$3,703
1962	159,724	336,207	[1] 1,608,466	[1] 2,862,366	(2)	(2)

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1958	10,090,877	10,153,414	200	$200	13,126,377	$13,948,614
1959	1,786,186	1,834,808	2,600	15,700	3,337,886	4,048,408
1960	76,158	118,615	57,500	45,312	1,836,879	3,086,864
1961	126,470	329,405	59,681	69,774	1,807,918	3,218,734
1962	335,539	624,927	14,639	41,028	2,118,368	3,864,528

[1] Excludes dimension limestone; included with "Other stone."
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

Talc.—At its mill in Ogden, Tri-State Minerals Co. ground crude talc, shipped from its mines outside the State, for use in manufacturing paint and paper.

Vermiculite.—Vermiculite was exfoliated at the Salt Lake City plant of Vermiculite-Intermountain, Inc., from crude ground material from Montana and used principally as an insulator.

TABLE 17.—Stone sold or used by producers, by uses

Use	1961		1962	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction short tons	590	$13,400	7,643	$41,617
Rubble do	3,000	86,000	3,137	88,700
Sawed stone cubic feet	(1)	(1)	[2] 7,589	49,155
Dressed stone do	(1)	(1)	[3] 2,884	4,812
Flagging do	[4] 2,564	7,000	[5] 2,884	7,875
Other do	[6] 13,372	46,202	----------	----------
Total (approximate, in short tons)	4,833	152,602	11,822	192,159
Crushed and broken stone:				
Riprap short tons	186,229	386,119	384,152	642,416
Metallurgical do	606,114	876,396	509,975	711,353
Concrete and roadstone do	(1)	(1)	128,484	126,602
Chemical do	(1)	(1)	----------	----------
Other do	[7] 1,010,742	[7] 1,803,617	[8] 1,083,935	[8] 2,191,998
Total do	1,803,085	3,066,132	2,106,546	3,672,369
Total stone (approximate, in short tons)	1,807,918	3,218,734	2,118,368	3,864,528

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Approximately 592 short tons.
[3] Approximately 225 short tons.
[4] Approximately 200 short tons.
[5] Approximately 225 short tons.
[6] Approximately 1,043 short tons.
[7] Includes stone used in railroad ballast, concrete and road metal, chemical, asphalt filler, coal dust, poultry grit, cement, lime, landscaping, roofing granules, explosives, building chips, and filter rock.
[8] Includes stone used in asphalt filler, coal dust, filter beds, poultry grit, cement, lime, roofing granules, landscaping, stucco, terrazzo, pottery, building chips, precast products, and exposed aggregate.

REVIEW BY COUNTIES

Beaver.—The 38-percent decrease in total value of mineral production was due to lower value of each of the mineral commodities produced except copper, pumice, and silver. More than one-half of the mineral-output value again came from metals. Copper with byproduct gold and silver was produced by Bogdanich Development Co. and Majestic Oil and Mining Co. at the Bawana mine near Milford; copper and zinc with byproduct gold and silver by Index-Daley Mines Co. at the Creole mine near Minersville; silver with byproduct gold, copper, lead, and zinc by Warren Outzen & Rollo Peterson at the Harrington-Hickory mine west of Milford; and uranium ore by Atkinson Exploration Co. at the Producer mine and Mystery Sniffer Mines, Inc., at the Mystery Sniffer mine northeast of Beaver.

Building blocks and associated products were manufactured from pumice mined near Milford. Henry Schoo produced perlite (shipped to Utco plant of Acme Lite-Wate Products, Inc., Salt Lake City, for expansion and use in plaster, concrete, and as a soil conditioner), and marble (crushed and used as building chips). Two hundred pounds of crystals (gem stone material) was collected by Orean Barney. Because of a lack of road construction, no sand and gravel was produced.

Box Elder.—Although sand and gravel was the leading commodity in value of mineral production, tapering off of interstate road construction caused a 49-percent drop in output and a 7-percent decrease in total value of mineral production. Crushed sandstone, ranked

TABLE 18.—Value of mineral production in Utah, by counties

County	1961	1962 [1]	Minerals produced in 1962 in order of value
Beaver	$217,288	$134,914	Copper, pumice, zinc, silver, uranium ore, gold, perlite, stone, lead, gem stones.
Box Elder	1,208,018	1,124,742	Sand and gravel, stone, lime, salt, gem stones, silver, lead.
Cache	557,837	690,300	Sand and gravel, stone, lime.
Carbon	25,721,209	18,776,366	Coal, natural gas, sand and gravel, petroleum, carbon dioxide.
Daggett	1,191,900	1,440,200	Sand and gravel, natural gas, natural gasoline, petroleum.
Davis	381,220	3,086,217	Sand and gravel, stone.
Duchesne	26,600	271,900	Sand and gravel, petroleum, natural gas.
Emery	[2] 8,733,830	6,080,659	Coal, uranium ore, sand and gravel, petroleum, vanadium, natural gas, gem stones, copper, silver.
Garfield	[2] 245,645	224,099	Uranium ore, vanadium, gem stones, sand and gravel.
Grand	[2] 1,827,269	2,628,402	Natural gas, uranium ore, petroleum, sand and gravel, vanadium, gem stones.
Iron	[3]	18,480,257	Iron ore, coal, sand and gravel, stone, gem stones.
Juab	1,237,893	1,498,213	Clays, uranium ore, stone, sand and gravel, fluorspar, barite, gem stones.
Kane	[2] 8,533,400	9,124,655	Sand and gravel, gem stones.
Millard	123,588	235,058	Sand and gravel, stone, pumice, gem stones, zinc, silver.
Morgan	7,625,871	[3]	Cement, stone, sand and gravel.
Piute	[3]	[3]	Uranium ore, zinc, silver, lead, gold, copper.
Rich	1,914,256	2,380,156	Phosphate rock, sand and gravel.
Salt Lake	177,208,701	182,185,923	Copper, molybdenum, gold, zinc, lead, silver, sand and gravel, cement, salt, lime, stone, clays.
San Juan	[2] 108,073,548	102,790,294	Petroleum, uranium ore, natural gas, LP gases, natural gasoline, vanadium, copper, sand and gravel, silver, zinc, gem stones.
Sanpete	145,221	174,756	Sand and gravel, salt, clays, zinc, lead, silver.
Sevier	1,290,559	1,328,162	Gypsum, coal, clays, sand and gravel, salt, gem stones.
Summit	1,639,948	3,888,447	Zinc, lead, silver, sand and gravel, copper, coal, gold, stone, clays.
Tooele	6,897,300	8,512,028	Potassium salts, lime, salt, stone, lead, zinc, silver, sand and gravel, copper, clays, gold, gem stones.
Uintah	28,085,937	33,150,708	Petroleum, gilsonite, natural gas, phosphate rock, sand and gravel, LP gases, natural gasoline, stone, gem stones.
Utah	1,474,465	2,273,933	Sand and gravel, stone, lime, clays, gem stones.
Wasatch	5,237,028	1,039,482	Stone, zinc, lead, silver, gold, copper, sand and gravel.
Washington	225,501	99,504	Sand and gravel, copper, stone, gem stones, silver, zinc.
Wayne	[2] 137,132	[3]	Gem stones, vanadium, uranium ore.
Weber	551,758	[3]	Sand and gravel, clays.
Undistributed [4]	[2] 26,276,025	8,792,169	
Total	[2] 416,789,000	410,412,000	

[1] Value of petroleum is preliminary.
[2] Revised figure.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Includes some sand and gravel, clays (1962), and gem stones that cannot be assigned to specific counties and values indicated by footnote 3.

second in production, was used principally by the Bureau of Reclamation for riprap; a small quantity was used for exposed aggregate. Utah-Idaho Sugar Co. produced quicklime for use in refining sugar at its plant at Garland. A slight gain was made in the output of solar-evaporated salt by Lake Crystal Salt Co. at Saline on Promontory Point.

Small quantities of silver and lead were produced by R. L. Casey & A. L. Pierce at the Silver Belle mine.

Cache.—More extensive road construction caused a 68-percent increase in sand and gravel production and a 195-percent-increase in stone. Output from nine operations (six commercial and three Government-and-contractor) was 431,900 tons of sand and gravel, representing virtually one-half of the mineral-output value. Lime, made from limestone produced by Legrand Johnson Corp. at The Amalgamated Sugar Co. quarry, was used in sugar refining at plants of The

Amalgamated Sugar Co. The Cache County Road Department produced 113,100 tons of crushed sandstone for concrete and road material.

Carbon.—Seventy-two percent of the coal mined in the State came from Carbon County; production, all from 23 mines, accounted for 93 percent of the total mineral-output value. Lower coal demand by the steel industry reduced production by 21 percent. Of 3.1 million tons of coal mined, slightly more than one-half was cut by machines; all was mechanically loaded; 2.5 million tons was cleaned by washing and 143,926 tons by pneumatic means; and 1.2 million tons was treated with oil or other materials. Seventy-one percent of the coal was produced by Kaiser Steel Corp. at Sunnyside Nos. 1, 2, and 3 mines; Independent Coal & Coke Co. at Castle Gate No. 4, Clear Creek No. 3, Kenilworth, and O'Connor No. 2 mines; and United States Steel Corp. at Columbia and Geneva mines.

The total production value of natural gas from Farnham Dome, Stone Cabin, and Clear Creek fields was $1.2 million—20 percent less than in 1961. Petroleum was produced from a well in the Jack Canyon field. Carbon dioxide increased and sand and gravel decreased in output value.

Daggett.—Sand and gravel, primarily used in constructing the Flaming Gorge Dam, accounted for 80 percent of the mineral-production value. The natural gas output from Mountain Fuel Supply Co. wells in the Clay Basin field was processed in the company plant at Manila. Gas was transported through pipelines to consumers in the vicinity of Salt Lake City. Natural gasoline from the Manila plant was used for blending stock at Salt Lake City refineries. Nearly 2,000 barrels of petroleum was recovered as drip oil from the Clay Basin gas wells.

Davis.—Sand and gravel production constituted the entire mineral output of the county, except for the output of a small quantity of miscellaneous stone produced for the U.S. Army Corps of Engineers for building stone, concrete, and roads. An increase in road construction by the Utah State Department of Highways created most of the demand for sand and gravel so that output advanced sevenfold in the county. Davis County Highway Department, Federal Forest Service, A 1 Sand & Gravel, Dayton & Miller Red E Mix Concrete, De Reice Balls, and Foss Lewis Sand & Gravel, Inc., also produced sand and gravel.

Duchesne.—New county road construction by the Utah State Department of Highways brought about an increased sand and gravel production. A gain of 236 percent in output value of petroleum resulted from three development-well discoveries and one wildcat. Natural gas was produced from a new gas well in the Blue Bell field.

Emery.—The 30-percent decrease in mineral-production value was caused largely by a 21-percent drop in the value of coal output. Emery County with 10 coal operations, accounting for 83 percent of the mineral-output value, was ranked second in quantity of coal mined in the State. Main coal producers were United States Fuel Co., United States Steel Corp., Minerals Development Corp., Cooperative Security Corp., Browning Coal Mine, and American Fuel Co. Of the 1.1 million tons of coal mined, 846,000 tons was cut by 23 machines, all was mechanically loaded, and 749,000 tons was treated with oil.

Uranium ore production shipments declined 63 percent; production came from 25 operations, compared with 33 in 1961. Principal producers, accounting for 94 percent of the output, were Four Corners Oil & Mineral Co., Union Carbide Nuclear Co., Central Oil & Mining Co., and Shattuck Denn Mining Corp. Vanadium and small quantities of copper and silver were recovered from part of the uranium ore mined and processed.

Sand and gravel output of 238,900 tons was 79 percent lower than in 1961 because of less road construction. Natural gas output value declined 24 percent although one new gas development well was completed and became productive. Production of 33,000 barrels of petroleum, from two development-well completions, added $90,400 to the county mineral-production value. Gem stone material collected, consisting of agate and dinosaur bone, was valued at $775.

Garfield.—Uranium ore output, with a value of $88,589 (an increase of 31 percent over that for 1961), led all other minerals produced in the county. Production of 2,927 tons, averaging 0.35 percent uranium oxide, came from 33 operations compared with 1,103 tons, averaging 0.67 percent uranium oxide, from 39 operations in 1961. Vanadium, an important byproduct of the uranium ore produced in the county, was recovered at mills in Colorado.

Gem stone material gathered—principally petrified wood and small quantities of agate, jasper, and dinosaur bone—increased in value from $10,630 in 1961 to $62,045 in 1962. Most of this material was collected in the vicinity of Escalante and the Henry Mountains.

Sand and gravel was produced for use in road construction.

Grand.—An increase in output value of 268 percent for petroleum and 42 percent for natural gas resulted from discoveries: 8 crude oil wells (3 wildcat and 5 development), and 14 gas wells (3 wildcat and 11 development). These two commodities contributed 52 percent of the total mineral-production value. Uranium ore output from 40 operations, compared with 59 in 1961, dropped 26 percent. Average grade of the ore was 0.28 percent uranium oxide compared with 0.26 percent in 1961. Vanadium production recovered entirely from uranium ores declined in somewhat the same proportion as the decline in uranium ore output. Building and road construction required 150,200 tons of sand and gravel. Gem stone material—comprised of agate, dinosaur bone, geyserite, jasper, and smoky quartz—valued at $1,603, was collected from various parts of the county.

Texas Gulf Sulphur Co. completed the first producing unit of its $30 million potash mine and processing plant at Cane Creek, near Moab [7]; 500,000-ton-per-year production was expected by spring. By yearend, a second unit was to be added to raise the output to 1.1 million tons per year.

Iron.—All of the iron ore produced in the State was shipped from six operations in Iron County. Iron ore output accounted for virtually all of the value of county mineral production. Value of shipments declined 28 percent.

Columbia-Geneva Steel Division, United States Steel Corp., received at its steel plants near Provo all of the ore produced from the Desert

[7] Engineering and Mining Journal. Projects Under Construction in 1962. V. 164, No. 1, January 1963, p. 82.

Mound and Iron Mountain mines by Columbia Iron Mining Co., subsidiary of United States Steel Corp., and most of the ore and concentrate shipped from the Iron Springs operation by Utah Construction & Mining Co. The cement industry used a small quantity of ore from the Iron Springs mine. Ore from the CF&I Blowout, Comstock, and Duncan mines—contracted by Utah Construction & Mining Co.—was shipped to the company plant at Pueblo, Colo.

A total of 45,742 tons of coal, valued at $215,920—16-percent lower value than in 1961—was mined by Koal Creek Coal Co. at Jones-Bullock mine, Tucker Coal Co. at Tucker mine, and Webster Coal Co. at Webster mine.

The Utah State Department of Highways used 15,200 tons of gravel in road construction. From the Utah Shamrock quarry, Willard B. Thompson produced 200 tons of crushed limestone to be used as roofing and landscaping material. Grant L. Nebeker and Utah Stone & Coal Co. quarried 225 tons of dimension sandstone from the Rasmussen quarry for building stone. A small quantity of gem stone material was collected at Iron Mountain by the Cedar City Rock Club.

Juab.—Clay production, principally that of halloysite and including a small quantity of fire clay, provided the major mineral-output value. Halloysite was mined by Filtrol Corp. at the Dragon mine, near Eureka, and processed at its plant in Salt Lake City for use as a catalyst in oil refining.

International Pipe and Ceramics Corp. produced fire clay from the Eureka pit.

Uranium ore, all produced by Topaz Uranium Co. at the Yellow Chief mine, was second in value of the minerals produced.

Beryllium Resources, Inc., later acquired by The Brush Beryllium Co.; Vitro Minerals Corp.; and Topaz Beryllium Co., a consolidated subsidiary of The Anaconda Company, explored the beryllium deposits in the Topaz and Spor Mountain areas. Vitro Chemical Co. tested material from the Spor Mountain area at its uranium processing plant at Salt Lake City. The Federal Bureau of Mines published a report [8] of metallurgical investigation of beryllium-bearing material from the Spor Mountain area.

General Refractories Co. produced crushed sandstone (quartzite) for refractories. Road construction by the Utah State Department of Highways consumed 22,400 tons of gravel. The entire fluorspar output in the State, 399 tons, came from operations of the Chesley & Black partnership at the Fluorine Queen mine and Willden Brothers at the Lost Sheep mine in the Spor Mountain district. A small quantity of barite was mined by D. J. Garrick near Trout Creek. Gem stone material, valued at $339 and consisting of agate and topaz, was collected by Robert's Rocks and Gifts, Stan's Shop, and Wasatch Gem Society.

Kane.—Sand and gravel valued at $9.1 million and gem stone material valued at $1,455 were the only minerals produced in the county. Of the total of 4,049,200 tons of sand and gravel output, 4,032,900 tons

[8] Montoya, J. W., R. Havens, and D. W. Bridges. Beryllium-Bearing Tuff from Spor Mountain, Utah: Its Chemical, Mineralogical and Physical Properties. BuMines Rept. of Inv. 6084, 1962, 15 pp.

was used by the Bureau of Reclamation in the Glen Canyon Dam construction; 16,300 tons was used by the Utah State Department of Highways in road construction. Petrified wood and agate were collected by the operators of Gemwood Mines and Makelprang Lapidary.

Millard.—Sand and gravel, stone, and pumice output accounted for 96 percent of the mineral-production value. Most of the sand and gravel output was used in road construction—114,500 tons by the Utah State Department of Highways and 900 tons by the Federal Forest Service; 400 tons was used for building construction by the National Park Service. George H. Chaffin, at the Leamington quarry, produced crushed limestone for use as flux and for making lime. Pumice (scoria) was mined and processed for use as lightweight aggregate and in building blocks. Glenn C. Osborne and the Wasatch Gem Society collected obsidian. Silver and zinc were recovered from ore produced by G. J. Rawley at the Blue Bell mine dump in the Gordon (Dog Valley) mining district.

Morgan.—Cement, stone, and sand and gravel were the only mineral commodities produced in the county. The production value of the Devil's Slide limestone quarry and cement plant of Ideal Cement Co. increased 7 percent over that of 1961. Portland and masonry cements were manufactured. The Devil's Slide plant furnished portland cement for the Flaming Gorge Dam; the last bucket of concrete was poured November 15.

Less road construction, because of completions, caused an 89-percent decrease in sand and gravel output—1.8 million tons in 1961 compared with 200,000 tons in 1962.

Piute.—Most of the output value of metals, which comprised the entire mineral production, came from uranium ore mined in seven operations by VCA and in one by D. L. Atherly & Sons. An 18-percent drop in production value occurred in 1962. The ore was shipped to Salt Lake City for processing at the Vitro Chemical Co. mill.

Gold, silver, copper, lead, and zinc were produced by Arundel Mining Co. at the Deer Trail mine, and gold and silver by Gold Standard Mining Co. at the Bully Boy mine. A small amount of mill cleanup was shipped.

Rich.—Most of the mineral-output value was contributed by phosphate rock production; a small part came from sand and gravel output. Production of phosphate rock—22 percent greater than in 1961—came from the Cherokee unit of San Francisco Chemical Co., near Randolph, and was shipped for processing to the company plant at Sage, Wyo. An increase in road construction more than doubled the sand and gravel production.

Salt Lake.—Metals accounted for 96 percent of the value of mineral output. The county was ranked first in the State and the State second in the Nation in copper production. The Utah Copper Division, Kennecott Copper Corp., at the Utah Copper mine was the major copper producer; led all operations in output of silver and gold; and was the only producer of molybdenum in the State. USSR&M Co. at the U.S. and Lark mine, one of the major lead-zinc sources in the world, and at the Butterfield project not only was the leader in production of lead and zinc in the State and county, but was second in

output of copper, silver, and gold. Important amounts of silver, lead, and zinc also were produced by Beeson Exploration and Grand Deposit Mining Co. at the Cardiff, Hirshman Estate, and Kennebec mines and by International Smelting and Refining Co. at the Murray slag dump. Copper production increased 2 percent in quantity and 5 percent in value; silver production decreased 3 percent in quantity and increased 13 percent in value; all other metals production decreased both in quantity and value.

The 600-ton-per-day uranium mill of Vitro Chemical Co. was operated throughout the year. The company successfully completed pilot plant tests on beryllium ore from the Spor Mountain area.

Throughput of 31.2 million barrels of crude petroleum at the four oil refineries in the Salt Lake City area was 1 percent less than in 1961.

Sand and gravel production dropped 33 percent in quantity but increased 36 percent in value because of a large reduction in road construction (using low-priced sand and gravel) and an impressive increase in building (using high-quality material) construction. Salt Lake County was placed fourth in the State in output from 20 operations, 17 commercial and 3 Government-and-contractor. Leading producers in descending order of output, each with a production of 200,000 tons or more, were Utah Sand & Gravel, South East Sand & Gravel, Harper-Jackson Sand & Gravel Co., and Reynolds Sand & Gravel Co.

Stone output increased but value decreased, compared with figures for 1961. Limestone was quarried by Portland Cement Co. of Utah at the Parleys Canyon quarry for producing cement; by Kennecott Copper Corp. at its Saltair Beach operation for use as flux; and by the Bureau of Public Roads and Utah State Department of Highways for use as riprap. Aggregate Supply Co. produced crushed sandstone for aggregates in precast products.

Portland cement, manufactured by Portland Cement Co. of Utah at its Salt Lake City plant, increased 7 percent in output value over that of 1961. Solar-evaporated salt produced by Morton Salt Co. at Saltair was virtually the same in quantity and value as in 1961. Kennecott Copper Corp. and Utah-Idaho Sugar Co. produced quicklime for use in ore processing and sugar refining at their respective plants. Heavy clay products were manufactured from clay produced by International Pipe and Ceramics Corp. at the Cottonwood pit.

San Juan.—The county was ranked second to Salt Lake County in total mineral-output value and led the State in producing petroleum, natural gas, natural gas liquids, uranium ore, and vanadium.

Because of water-flooding and repressuring programs designed for maximum oil recovery from reservoirs in the Greater Aneth area, petroleum production from 600 wells in 18 established fields and 6 undesignated fields was 10 percent less than in 1961. Water was injected in 58 wells in the Aneth unit, in 18 wells in the McElmo unit, in 6 wells in the Ratherford unit, and in 2 wells in the White Mesa unit. Of a total of 32 wildcat wells completed, oil was discovered in 5; of 48 development wells completed, oil was discovered in 31 and condensate in 3. One of the development wells was drilled for service.

Natural gas production increased 8 percent. Most of the gas output came from oil wells, largely in the Greater Aneth area, and was processed at the Blanding plant of El Paso Natural Gas Co. Natural gas liquids (natural gasoline, butane, and propane), recovered at the Blanding plant, were transported by pipeline to the company fractionation plant at Wingate, N. Mex., for processing.

Uranium ore production from 130 operations, compared with 163 in 1961, decreased 26 percent in total tonnage but only 4 percent in value because the ore averaged 0.37 percent uranium oxide, compared with 0.29 percent in 1961. Leading producers were Atlas Minerals Division, Atlas Corp.; Hecla Mining Co.; The Hidden Splendor Mining Co.; Homestake Mining Co.; Standard Metals Corp.; Texas-Zinc Minerals Corp.; Uranium Reduction Co.; and Utex Exploration Co. Some of the uranium ores produced in the county contained significant vanadium content, which was recovered in recovery units in uranium-processing mills in Colorado. The Texas-Zinc Minerals Corp. mill at Mexican Hat recovered byproduct concentrate containing copper, silver, and zinc from uranium ores.

Sanpete.—An increase in sand and gravel production from 174,300 tons in 1961 to 294,100 tons in 1962 was largely responsible for the 20-percent advance in total mineral-output value. The sand and gravel output, most of which was used in road construction, was by Cox Brothers and Hales Sand & Gravel. Stock-feed salt was produced from a rock-salt mine near Redmond by Albert Poulson. A small tonnage of clay, used for a poultry-feed supplement, was mined from the Azomite pit by Azome Utah Mining Co. Lead-zinc ore was mined by Santobar Mining Corp. at the Santobar mine.

Sevier.—Crews of the Federal Forest Service and contractors for the Utah State Department of Highways produced noncommercial sand and gravel. Producers of commercial sand and gravel were Hales Sand & Gravel and Herring Sand & Gravel Co. The entire State output of gypsum (5 percent more than in 1961) was produced by Bestwall Gypsum Co. and United States Gypsum Co., both with mines and wallboard-manufacturing plants near Sigurd. Coal production of 49,393 tons, 2,050 tons more than in 1961, was by Southern Utah Fuel Co. at the Southern Utah Fuel No. 1 mine. Bentonite was mined by Western Clay & Metals Co. at the Redmond pit and by Bosshardt Bros. at the Bosshardt pit for use as refractories, rotary-drilling mud, pond and ditch lining, and roofing material. Fuller's earth was produced by Western Clay & Metals Co. at the Aurora pit for use as a filtering and decolorizing agent. Rock salt was mined by Poulson Brothers Salt Co. for stock-feed salt. Agate was collected by the Shaheen Cafe.

Summit.—Metals output, led by zinc, accounted for 91 percent of the value of mineral production. Gold, silver, copper, lead, and zinc were mined by United Park City Mines Co. at the United Park City mine and by Keystone Mining Co. and United Park City Mines Co. (joint venture) at the Keystone mine. Gold, silver, and copper were recovered from Ontario mine dump material produced by McFarland & Hullinger and from Daly West mine dump material produced by Wortley Co.; both materials were used as smelter flux.

An 84-percent decline in sand and gravel production resulted from the decrease in road construction. Most of the output of 249,000 tons was used as paving gravel by the Utah State Department of Highways. The only commercial production, made by Wortley Co., was 19,000 tons of miscellaneous sand. Rocky Mountain Quarries produced 796 tons of dimension sandstone: 571 tons of sawed stone and 225 tons of flagging. An output of 19,509 tons of coal (virtually the same production as in 1961) was made by Chappell Coal Co. at the Chappell mine. Miscellaneous clay, for manufacturing heavy clay products, was produced by International Pipe and Ceramics Corp. at the Henefer Clay pit and Interstate Brick Co. at the Henefer pit.

Tooele.—A 23-percent gain in mineral-output value was recorded; value of production of all minerals gained except gem stone material (valued at $155 as compared with $1,285 in 1961).

Shipments of potash from current production and reserves were 21 percent above those of 1961. Bonneville, Ltd., recovered potash at its plant at Wendover from brines collected in ditches and pumped from wells. At a relatively shallow depth, the water table in the Wendover area leaches salts from the ancient bed of Lake Bonneville. Annual rainfall largely determines the quantity of brine available for processing. Following 3 years of very dry weather, 1962 was relatively wet and, consequently, the quantity of available brine increased substantially. However, the increased rainfall was accompanied by unseasonably cold weather which reduced the evaporation rate in the ponds, and, hence, the quantity of potash precipitated was reduced.

Construction of a compacting plant and a 10,000-ton coarse-potash storage bin, began in 1961, was completed in May and placed in operation. Although the compacting plant produced a coarse granular product, more desirable than a fine product for some uses, shipments of fine-grained material were to continue. The company continued its research program to recover economically the magnesia, bromine, and lithium contained in the brines. Brines, depleted of potash, were pumped to other ponds for further evaporation. The precipitated salt (NaCl) was harvested, processed, and marketed by Utah Salt Co. at its plant near Wendover. Leslie Salt Co., north of Tooele, and Solar Salt Co., northwest of Grantsville, recovered salt by solar evaporation from brines derived from Great Salt Lake. The quantity of salt recovered by the three companies in 1962 was 166,177 tons, valued at $1.55 million.

A 20-percent gain was realized in quantity of stone quarried. Utah Calcium Co., The Utah Lime and Stone Co., and Utah Marblehead Lime Co. produced crushed limestone. The product, accounting for most of the stone production, was used principally for making lime. It was also used as flux, roofing, and asphalt filler; in cement, stucco, terrazzo, cast stone; and for poultry grit and filter beds.

Quicklime and hydrated lime were produced by The Utah Lime and Stone Co. at its processing plant near Grantsville. Utah Marblehead Lime Co. made dead-burned dolomite from rock quarried near Tooele.

Sand and gravel, produced by England Construction, Inc., was used in building and road construction.

International Pipe and Ceramics Corp. and Interstate Brick Co. mined clay from pits at Five Mile Pass for producing heavy clay products.

The output value of gold, silver, copper, lead, and zinc was $1.26 million, 103 percent greater than in 1961. The gain largely was due to increased output at the Ophir unit of USSR&M Co. by McFarland & Hullinger, lessees. Other production came from smelter cleanup and cold slag reclaimed from the Tooele dump by International Smelting and Refining Co., from the Mecca (Wandering Jew) mine by Mecca Mining Co., from the Argent mine by Marlo Chamberlain, from the Black Hawk mine by George Justice, and from the Rainbow mine by Homer C. Whitlock.

Uintah.—The county was ranked third in value of mineral production in the State. The mineral fuels—petroleum, natural gas, natural gas liquids, and gilsonite—accounted for 95 percent of the county mineral value. Produced from 229 wells in 1 undesignated and 7 established fields, petroleum, the leading commodity, gained 5 percent in output over that of 1961. California Oil Co., with 153 operating wells in the Red Wash field, was the major producer. Sixty-three percent of the natural gas production came from oil wells, principally in the Red Wash field; the remainder came from 58 gas wells in 11 fields. Of 24 completed wildcat wells, crude oil was discovered in 2 and gas in 6; of 78 completed development wells, crude oil was discovered in 36 and gas in 28. Natural gasoline and liquified petroleum gases (butane and propane) were produced at the California Oil Co., Western Division, natural gas processing plant at Jensen from oil well gas produced in the Red Wash field.

All of the gilsonite (uintahite) output in the State and in the Nation came from the Bonanza area in Uintah County. Most of the production was mined by American Gilsonite Co. at the Bonanza mines and transported as slurry through a 72-mile pipeline to the company refinery at Fruita, Colo., for processing. Ziegler Chemical & Mineral Corp. (formerly G. S. Ziegler & Co.), the only other producer, mined a small part of the total output at the Little Bonanza mine.

A 10-percent increase was made in the value of phosphate rock mined by San Francisco Chemical Co. at the Vernal unit. The rock was shipped to Western Phosphates, Inc., at Garfield for processing.

Production of 403,400 tons of sand and gravel in seven operations (four commercial and three Government-and-contractor) was used in building and road construction. The U.S. Army Corps of Engineers used 5,871 tons of limestone, quarried by A & B Construction Co. and Hensen Construction Co., for riprap.

Gem stone material—agate and petrified wood—was collected by Francis Boegel and Wilson's Rock Shop.

Utah.—Nonmetals, consisting of sand and gravel, stone, lime, clays, and gem stone material (6 pounds of chrysocolla), comprised the entire mineral output. Limestone was quarried by the Columbia-Geneva Steel Division, United States Steel Corp., at the Keigley quarry principally for use as flux, in refractories, and as road metal; by Lakeside Lime & Stone Co. for use in dusting coal mines and in making

lime; and by Cannon Papanikolas (contractor for the U.S. Army Corps of Engineers) for use as building stone and roadstone.

Sand and gravel production, used mostly for building and road construction, increased 11-fold in output over that for 1961. The production came from 11 operations, 10 commercial and 1 Government-and-contractor.

Lakeside Lime & Stone Co. produced hydrated lime and quicklime, largely used for chemical and other industrial purposes; small quantities of hydrated lime were used by the construction and agricultural industries.

Fire clay was produced for use in heavy clay products and refractories by International Pipe and Ceramics Corp. at the Clinton Clay pit, by R. D. Wadley Clay Co. at the Wadley pit, and by Western Fire Clay Co. at the Fawn pit. Miscellaneous clay for use in heavy clay products was produced by International Pipe and Ceramics Corp. at the Elberta pit and by Loyd R. Stubbs at the Northeast pit.

Wasatch.—The production value of metals, accounting for 56 percent of the county value of mineral output, decreased 89 percent below that for 1961. Smaller quantities of gold, silver, copper, lead, and zinc were mined from the Mayflower mine at Keetley, and from the United Park City mine at Park City.

During the year, at the Mayflower mine, Hecla deepened the No. 1 shaft 400 feet to the 2,400-foot level, where development work was conducted. A 400-ton-per-day concentrator was constructed north of the Mayflower adit and placed in operation in December. The company expected to treat 100,000 tons of ore annually.

Stone output, valued at $439,787, was the leading mineral commodity produced in the county. The Bureau of Reclamation used 159,724 tons of granite for riprap and 3,312 tons of sandstone for riprap, concrete aggregate, and roadstone: The granite was produced by contractors at seven operations and the sandstone by a contractor at one operation. Commercial operators produced 3,420 tons of dimension sandstone for use in building construction.

Sand and gravel production, totaling 34,400 tons, was used by the Utah State Department of Highways and the Federal Forest Service for road and building construction.

Washington.—Sand and gravel was used by the Utah State Department of Highways and the Washington County Road Supervisors for road construction.

Utah Scenic Stone Corp. quarried and sawed 21 tons (269 cubic feet) of dimension sandstone at the Picture Stone quarry. The Fawcett Hobby Shop collected alabaster.

Wayne.—Mineral commodities produced were gem stone materials, uranium ore, and vanadium. Jasper and opalite were collected by Orean Barney from the Thousand Lake Range and jasper was collected by the Rocky Mountain Mineral Craft from the Hanksville area. Uranium ore production came from one operation—Leo D. Jackson & J. S. Allen at Big Jim Group. Vanadium was recovered at the Climax Uranium Corp. mill at Grand Junction, Colo., from uranium ores produced in Wayne County.

Weber.—Sand and gravel and clays were the only mineral commodities produced. Of 301,200 tons output of sand and gravel, 226,000 tons was used in building construction and 75,200 tons in road construction. Most of the road material was used by the city of Ogden and the Utah State Department of Highways. Holley Co. and Douglas B. Stevens Co. (commercial operators) were the major producers.

International Pipe and Ceramics Corp. produced miscellaneous clay from the Harrisville and the Pleasant View pits for use in making heavy clay products.

The Mineral Industry of Vermont

By James R. Kerr [1]

DESPITE slackened roadbuilding activity, which depressed the aggregate market, the value of mineral production increased 3 percent to $25 million. Increased demand for valuable dimension stones, marble, granite, and slate offset decreased aggregate production. Asbestos production continued at a high rate, and output of talc increased over 1961.

Rutland County with its valuable marble and slate output led in value of mineral production. Washington and Orleans Counties followed, with granite and asbestos their leading minerals, respectively.

TABLE 1.—Mineral production in Vermont [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Gem stones	(2)	$2	(2)	$2
Sand and gravel short tons	2,232,266	1,567	1,430,466	1,076
Stone do	2,731,418	18,715	1,714,676	19,815
Value of items that cannot be disclosed:				
Asbestos, clays, lime, talc		4,012		4,237
Total		[3] 24,296		25,130

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Revised figure.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Asbestos.—Chrysotile asbestos was produced in Orleans County at a slightly higher rate than in 1961. The crude material was processed in Lamoille County. Eighteen grades were shipped; they varied in price from $29 to $370 per ton, depending upon length and quality of fiber.

Clays.—Kaolin was produced in Addison County, and miscellaneous clay, in Chittenden and Rutland Counties. Kaolin had a wide variety of markets, chief among which was the floor and wall tile market. Miscellaneous clay was used mainly for building brick.

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Gem Stones.—Miscellaneous gem minerals, including actinolite, magnetite, pyrite, talc, and garnet, were collected by hobbyists at scattered locations throughout the State.

Lime.—Combined production of quicklime and hydrated lime increased significantly. The paper industry consumed most of the quicklime, and the major portion of the hydrated lime was used in construction.

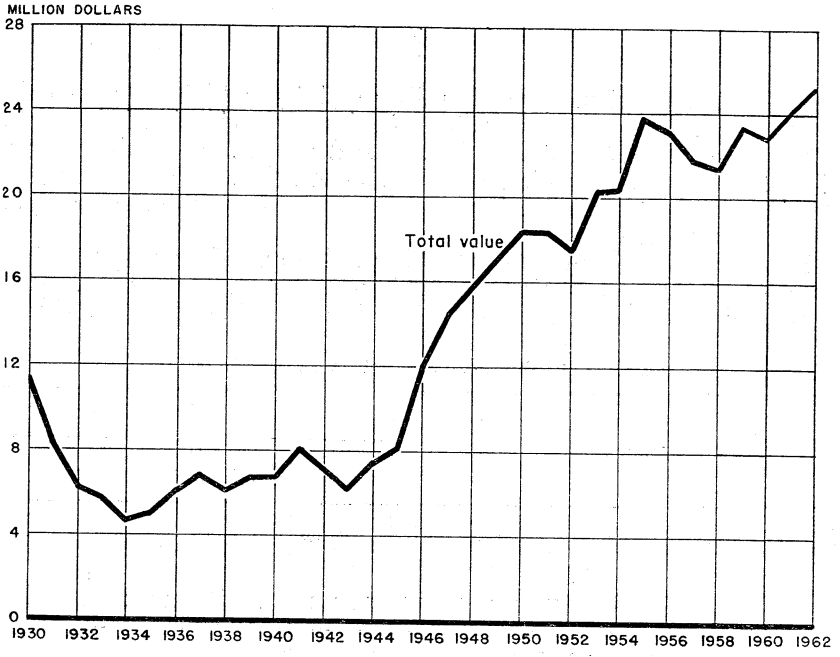

FIGURE 1.—Total value of mineral production in Vermont 1930–62.

Mica, Reconstituted.—Specially delaminated mica scrap was used to produce reconstituted mica at Rutland.

Sand and Gravel.—Slackened activity in roadbuilding caused a 36-percent decrease in total sand and gravel production. Production of paving gravel was less than half that of 1961. Paving remained the largest market, consuming 60 percent of the total output. Of the output of 30 commercial plants, 46 percent was sand, and 54 percent was gravel. Average price per ton decreased 9 cents to $1.00, even though the proportion of processed material increased by 2 percent to 87 percent.

Government-and-contractor output of sand and gravel decreased 43 percent owing to greatly reduced production under contract for the State. State crews, however, were quite active, producing more than twice the output of 1961. A significant quantity of fill gravel was produced, indicating the initiation of additional roadbuilding programs. Government-and-contractor operations (primarily for the Vermont State Highway Department) are summarized in table 2 and not listed in the county review section.

TABLE 2.—Sand and gravel production by Government-and-contractor operations, by counties

(Short tons)

County	1961	1962	County	1961	1962
Addison	16,913	10,132	Orleans	117,198	49,255
Bennington	119,973	78,288	Rutland	9,000	36,138
Caledonia	13,500	20,147	Washington	53,787	73,319
Chittenden	105,953	70,946	Windham	417,215	9,036
Essex	183,938	26,107	Windsor	118,889	99,545
Franklin	49,892	204,104	Unspecified	59,108	44,354
Grand Isle	3,000	16,458			
Lamoille	38,061	9,500	Total	1,312,427	753,346
Orange	6,000	6,017			

Stone.—Although stone production decreased 37 percent, the value of production increased 6 percent—owing to increased output of dimension granite, marble, and slate, the higher-unit-price products. Completion of some roadbuilding programs caused curtailed output of crushed limestone, sandstone, and granite. A fourfold increase in production of dimension granite for dressed architectural uses was the leading factor in overall increased granite valuation. Instrumental in the increased slate production was the doubled demand for roofing slate. Output of slate for structural and sanitary uses and for flagging also increased. Production of dressed building marble for both interior and exterior uses increased significantly. Leading stone producing counties were Rutland and Washington.

Talc.—Production of talc increased 24 percent, owing to increased demand by the roofing and rubber industries. The insecticide market, which was gradually turning from powder to liquid products, had less need for talc in recent years.

REVIEW BY COUNTIES

Addison.—Vermont Associated Lime Industry, Inc., reopened its New Haven limestone quarry and produced a small tonnage of agricultural stone (agstone). The company also produced hydrated lime at New Haven from quicklime shipped from its Winooski calcining plant in Chittenden County. Vermont Kaolin Corp. continued operating its Electra open-pit kaolin mine near Bristol. The company, which began installing a wetmill during the year, reported that a strike and the abandonment of the Rutland Railroad adversely affected operations.

Bennington.—Building and paving sand and gravel and sand for winter road maintenance was produced by Burgess Bros. and William E. Dailey, Jr., near Bennington.

Caledonia.—Sand and gravel for paving was produced near St. Johnsbury by Caledonia Sand & Gravel Co., Inc., and Lawrence Sangravco, Inc.

Chittenden.—Limestone was quarried near Burlington and crushed by L. A. Demers Crushed Rock Co. for roadstone. The company reported output of a larger proportion of finer sized material to meet local demand. The Vermont State Highway Department produced crushed limestone for road construction. Vermont Associated Lime

Industry, Inc., produced crushed limestone for agstone and for lime manufacture. The company lime output was consumed largely by the paper industry.

TABLE 3.—Value of mineral production in Vermont, by counties

County	1961	1962	Minerals produced in 1962, in order of value
Addison	(1)	(1)	Lime, clays, stone, sand and gravel.
Bennington	(1)	$180,445	Sand and gravel.
Caledonia	(1)	(1)	Sand and gravel.
Chittenden	[2] $1,775,593	1,150,468	Stone, sand and gravel, lime, clays.
Essex	(1)	(1)	Sand and gravel.
Franklin	(1)	(1)	Stone, sand and gravel.
Grand Isle	1,600	(1)	Stone, sand and gravel.
Lamoille	(1)	(1)	Talc, sand and gravel.
Orange	(1)	(1)	Stone, sand and gravel.
Orleans	(1)	(1)	Asbestos, stone, sand and gravel.
Rutland	9,990,820	11,774,578	Stone, sand and gravel, clays.
Washington	(1)	(1)	Stone, sand and gravel.
Windham	1,312,579	218,581	Stone, sand and gravel, talc.
Windsor	520,145	534,880	Stone, talc, sand and gravel.
Undistributed	10,695,693	11,271,150	
Total	[2] 24,296,000	25,130,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Revised figure.

Sand and gravel mainly for paving and fill was produced at four operations near Burlington. W. C. Kirby, contractor, was the leading producer.

Miscellaneous clay for building brick was mined from a glacial deposit near Essex Junction by the Densmore Brick Co.

Essex.—A. Booska Sand & Gravel Co., Inc., produced paving sand and gravel at a stationary plant.

Franklin.—Limestone was quarried near Swanton by Swanton Lime Works, Inc., chiefly for use as roadstone and agstone. Significant quantities also were sold to papermills and to mineral food dealers. No commercial output of sand and gravel was reported.

Grand Isle.—Vermont Marble Co. resumed operation of the Isle La Motte quarry, producing both dimension and crushed marble.

Lamoille.—Eastern Magnesia Talc Co., Inc., mined crude talc at the No. 4 mine near Johnson. Output was ground at the company mill for sale chiefly to the roofing, rubber, and paper industries. A small tonnage of crude talc was shipped to a foundry in Cleveland.

Albert Nadeau operated a portable plant near Johnson producing sand and gravel for building and paving. Kenneth Farr produced bank-run sand and gravel near Morrisville.

Orange.—Rock of Ages Corp., Pirie Division, quarried dimension granite near Williamstown for rough monumental stone and rubble. Willard B. Martin produced paving gravel and Levi Lemieux produced sand and gravel for miscellaneous uses.

Orleans.—Vermont Asbestos Mines, Division of the Ruberoid Co., mined chrysotile asbestos near Lowell for processing at the company mill across the county line in Lamoille County. Eighteen grades of asbestos determined by length and quality of fiber were shipped. The company also mined miscellaneous stone at the same location as a by-product for sale as fill.

Irio Bianchi quarried a small quantity of rough construction building granite. H. G. Calkins produced paving sand and gravel for the State highway department at a stationary plant near Coventry. The State highway department produced crushed sandstone for roadstone.

Rutland.—Vermont Marble Co. operated four quarries and five finishing plants and produced dimension marble for a variety of building and monumental applications. Production was significantly greater than in 1961 despite the fact that the company's Blue quarry was idle. The greatest demand was for cut and dressed building marble for both exterior and interior uses. Green Mountain Marble Division of Georgia Marble Co. quarried cut and dressed monumental marble and cut and dressed building marble for exterior uses. Sharply increased demand for roofing slate was the major factor in a 31-percent increase in overall slate production. Output for structural and sanitary uses and for flagging also increased. Of the 22 active quarries, the larger were operated by Vermont Structural Slate Co. (5 quarries), Tatko Bros. Slate Co., Hilltop Slate Co., and Fair Haven Slate Co. Limestone for whiting was quarried by White Pigment Corp. at South Wallingford and shipped to the company mill at Florence for processing. The company's Florence quarry was closed permanently and filled with water. Crushed limestone primarily for roadstone, stone sand, and agstone was produced by Vermarco Lime Co. at the Loveland quarry near Florence.

J. P. Carrara produced paving sand and gravel. Vermont Paving Corp., a new producer in 1961, did not operate in 1962. Rutland Fire Clay Co. produced furnace and refractory cement from its miscellaneous clay stockpile.

Washington.—The Rock of Ages Corp. quarried dimension granite chiefly for rough monumental uses at the Graniteville, Wetmore and Morse, and E. L. Smith quarries. Furthermore, the company, in cooperation with the John Swenson Granite Co., Inc., operated the Woodbury quarry at Woodbury. Output of this quarry was processed in both companys' mills to fill a contract for dressed architectural granite. The Charles A. Pillette granite quarry at Calais was purchased by S. L. Garand Granite Co., Inc., of Montpelier, which quarried rough architectural stone. Wells-Lamson Quarry Co., Inc., produced rough monumental granite at Websterville as well as crushed granite for roadstone.

Sand and gravel was produced at three locations. Kings Pit at South Barre was the leading producer.

Windham.—The State highway department quarried sandstone for road construction. Brattleboro Sand & Gravel Co. produced building and paving sand and gravel at a stationary plant near Brattleboro.

Vermont Talc Co. mined talc near Windham for grinding at the company mill at Chester in Windsor County. The talc was used for insecticides, rubber, paper, and plastics.

Windsor.—Vermont Marble Co. quarried dimension marble at its Rochester quarry. Crushed marble also was produced for use as flagging, chips, etc. The Rock of Ages Corp. purchased the Bethel quarry of Barre Building Granite Corp. and produced rough architectural stone. The company also sold crushed granite for roadstone.

The Eastern Magnesia Talc Co., Inc., operated its Hammondsville No. 3 mine near Reading, producing crude talc for grinding at its mill at Chester. The company installed a conveyor from the first level to a rock shed on the surface.

Sand and gravel for building and paving was produced by Sharon Sand & Gravel, Inc., Sharon, and Martin Marietta Corp., Windsor.

The Mineral Industry of Virginia

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Virginia Division of Mineral Resources for collecting information on all minerals except fuels.

By Robert W. Metcalf,[1] James L. Calver,[2] and Victoria M. Dorchak[3]

VALUE of mineral production in Virginia in 1962 was only slightly less than that in 1961, and only 2 percent under the peak value of 1957. Records in both quantity and value were established by stone, clays, and kyanite, and in value by sand and gravel. Significant increases in value were also made by aplite, masonry cement, iron oxide pigments, and titanium concentrate. Small decreases were indicated in output of the chief construction materials other than masonry cement and stone, portland cement, gypsum, and sand and gravel. Active road construction was the leading factor in the 12 percent rise in output of stone and it led to the opening of many new stone quarries. Output of lead increased 9 percent, but value was lower, because of an 11 percent drop in average value per pound compared with 1961. The principal minerals in order of value of production were again coal, stone, portland cement, sand and gravel, lime, and zinc. Fifty-three percent of the total value of mineral production in the State represented the value of fuels, compared with 57 percent in 1961. The value of nonmetals rose to 43 percent of the total and that of metals remained at 4 percent of the total State value.

The occurrence of mica and feldspar in Virginia, the rocks from which they are obtained, and the opportunities for future development were described.[4] Two reports on oil and gas wells in Virginia also were published.[5] Reports describing the geology and mineral resources of certain areas of Virginia were published, including Albemarle County,[6] the Williamsville Quadrangle,[7] and the Luray Caverns area.[8] A detailed study was made of the concentration of fluorides in the wells of the coastal plain.[9]

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[3] Statistical clerk, Bureau of Mines, Pittsburgh, Pa.
[4] Brown, William Randall. Mica and Feldspar Deposits of Virginia. Virginia Division of Mineral Resources. Min. Res. Rept. No. 3. Charlottesville, Va. 1962. 195 pp.
[5] LeVan, D. C. Wells Drilled for Oil and Gas in Virginia Prior to 1962. Virginia Division of Mineral Resources, Min. Res. Rept. No. 4, Charlottesville, Va., 1962. 47 pp.
LeVan, D. C. Supplement to Catalogue of Oil and Gas Wells Samples Added to Resposi-tory, Aug. 1, 1959 to Jan. 1, 1962. Charlottesville, Va., 1962, 5 pp.
[6] Nelson, Wilbur A. Geology and Mineral Resources of Albemarle County. Virginia Division of Mineral Resources, Bull. 77, Charlottesville, Va., 1962, 92 pp.
[7] Bick, Kenneth F. Geology of the Williamsville Quadrangle. Virginia Division of Mineral Resources Rept. of Inv. No. 2, Charlottesville, Va., 1962. 40 pp.
[8] Hack, John T., and Durloo, Leslie, H., Jr. Geology of Luray Caverns, Va. Virginia Division of Mineral Resources, Rept. of Inv. No. 3, Charlottesville, Va., 1962, 43 pp.
[9] Sinnott, Allen, and George W. Whetstone. Fluorides in Well Waters of the Virginia Coastal Plain. Virginia Minerals, v. 8, No. 1, February 1962, pp. 4–11.

TABLE 1.—Mineral production in Virginia [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Aplite thousand long tons	97	$651	125	$912
Clays thousand short tons	1,406	1,332	1,464	1,444
Coal (bituminous) do	30,332	126,121	29,474	117,560
Gem stones	[2]	6	[2]	6
Lead (recoverable content of ores, etc.) short tons	3,733	769	4,059	747
Lime thousand short tons	[3] 657	[3] 7,375	615	7,668
Natural gas million cubic feet	2,466	668	2,499	677
Petroleum (crude) thousand 42-gallon barrels	2	[5]	[4] 3	[5]
Sand and gravel thousand short tons	9,839	14,697	9,745	16,375
Stone do	22,934	39,206	25,766	43,121
Zinc (recoverable content of ores, etc.) [6] short tons	29,163	6,726	26,479	6,141
Value of items that cannot be disclosed: Portland cement, masonry cement, feldspar, gypsum, iron ore (pigment material), kyanite, mica, sheet (1961), pyrites, salt, soapstone, titanium concentrate (ilmenite and rutile), and values indicated by footnote 5		[3] 27,747		27,843
Total		[3] 225,298		222,494

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Revised figure.
[4] Preliminary figure.
[5] Figure withheld to avoid disclosing individual company confidential data.
[6] Recoverable zinc valued at the yearly average price of prime western slab zinc, East St. Louis market. Value established after transportation, smelting, and manufacturing charges have been added to the value of ore at the mine.

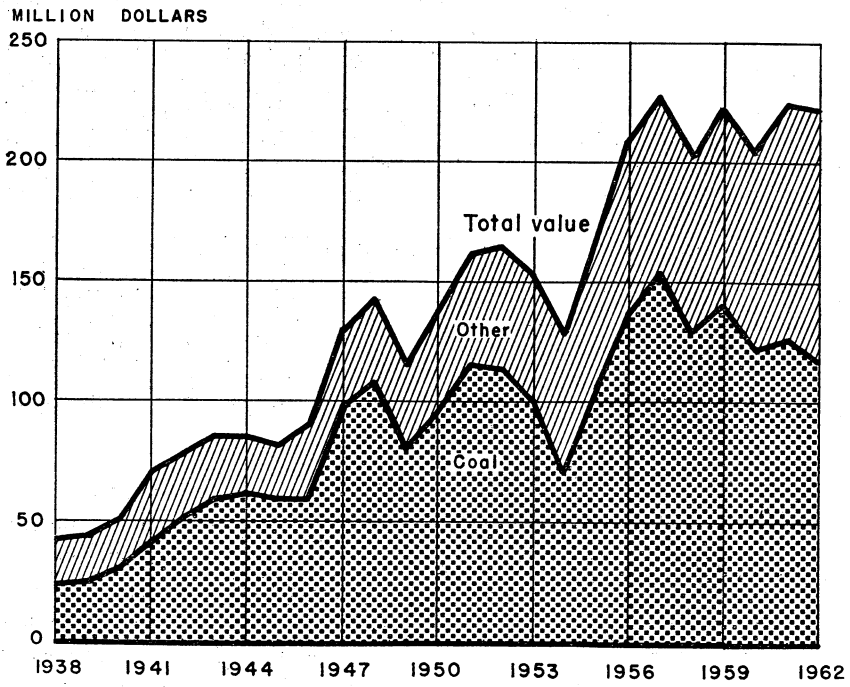

FIGURE 1.—Value of coal and total value of mineral production in Virginia, 1938–62.

Employment and Injuries.—According to preliminary data, nonfatal accidents in the metals industries and in quarries and mills dropped considerably compared with 1961. Nonfatal (lost time) accidents in the sand and gravel industry showed a moderate increase. One fatality was reported in 1962 for the metal industry (none in 1961) and three for quarries and mills (five in 1961). Fatalities in coal mines decreased from 30 in 1961 to 22. In the 1962 National Safety Competition, eight Virginia quarries achieved outstanding safety records by working from about 31,000 to nearly 84,000 man-hours without lost-time injuries. In the Nonmetals Group of the same competition there were two mines receiving outstanding safety awards by working about 35,000 and 60,000 man-hours, respectively, without disabling injuries. One mine in the Open-pit Group achieved an outstanding safety record by working nearly 85,000 man-hours without a disabling work injury.

TABLE 2.—Employment and injuries for selected mineral industries

Industry	Average number of men working	Total man-hours	Total number of lost-time injuries		Number of injuries per million man-hours	
			Fatal	Nonfatal	Fatal	Nonfatal
1961:						
Coal mines	13,148	21,108,726	30	1,006	1.42	47.66
Metals [1]	393	789,417	----	48	----	60.80
Clay mines [2]	61	115,187	----	3	----	26.04
Nonmetal mines [3]	224	438,942	----	3	----	6.83
Quarries and mills [4]	3,643	7,870,616	5	192	.64	24.39
Sand and gravel [5]	670	1,473,792	----	39	----	26.46
1962: [6]						
Coal mines	(7)	(7)	22	(7)	(7)	(7)
Metals [1]	384	776,519	1	28	1.29	36.06
Clay mines [2]	56	94,937	----	3	----	31.60
Nonmetal mines [3]	225	405,000	----	2	----	4.94
Quarries and mills [4]	4,000	8,650,000	3	140	.35	16.18
Sand and gravel [5]	726	1,568,922	----	48	----	30.59

[1] Includes mine and mill data; excludes officeworkers.
[2] Excludes mill data and officeworkers.
[3] Excludes clay mines, also nonmetal millworkers and officeworkers.
[4] Includes cement and lime plants having no quarry operations; excludes officeworkers.
[5] Excludes officeworkers.
[6] Preliminary figures.
[7] Data not available.

Trends and Developments.—Indicative of the increasing export trade as well as domestic shipments by ship or barge was the loading of the first coal both for foreign and for domestic shipment at the new Norfolk & Western Railway Lambert's Point pier No. 6. The domestic shipment was destined for the Bethlehem Steel Co. Sparrows Point, Md., steel mill, and the export shipment, for Italy.

The Office of Coal Research granted a $132,000 2-year contract to Virginia Polytechnic Institute, Blacksburg, for developing a computer program to formulate scientific methods to aid coal operators in reducing the costs of production and operation.[10]

Vitally influencing the distribution of raw materials for Virginia building and highway construction was the spread of distribution centers by the large cement producing companies. Among the companies opening large facilities of this type were Universal Atlas Cement Co., at Sewell's Point, Atlantic Cement Co., at South Norfolk,

[10] Mechanization. O.C.R. Awards Contracts. V. 26, No. 5, May 1962, p. 65.

and Lehigh Portland Cement Co., at Richmond and Portsmouth. A new distribution center would soon be established at Waynesboro. These new facilities would provide additional storage and distribution for cement over a wide area in Virginia.

Outstanding among developments affecting the Virginia mineral and industrial economy were a projected $3.5 million test reactor and nuclear laboratory to be erected at Lynchburg, by Babcock & Wilcox Co.; the projected construction of an electric steel mill near Norfolk by Intercoastal Steel Corp.; and the installation at Roanoke of the first continuous steel casting plant in the United States. The machine devised for the last-named operation, in one continuous process, turns a stream of molten steel into bars ready for the production line. This new development was the result of 15 years of experimental pilot plant operation by Babcock & Wilcox at its research plant in Beaver Falls, Pa. The continuous casting machine was delivered in December, and the Roanoke plant was to be on a three-shift operation by March 1963. The molten steel in 22-ton heats would be poured into molds on a pouring floor 80 feet above ground level, and the bars would be formed and solidified during the descent to the cooling bed on the ground.[11] The Intercoastal Steel Corp. electric mill would utilize scrap iron in making its steel products, and major additions to the mill would include a melting shop and a 60- by 400-foot mill. The Babcock & Wilcox nuclear reactor would be rated as a 6,000 thermo kilowatt test machine and be especially equipped for radioactive material examination.[12]

Legislation and Government Programs.—No sales of mica were reported in 1962. No purchases of Virginia mica were made by the Government through the General Services Administration at either the Spruce Pine, N.C., or the Franklin, N.H., Materials Purchase Depots.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Production of bituminous coal continued at a high level and was only 3 percent less than that of 1961, the former high year, and only slightly below 1959, the second highest year. The value of output, however, was 7 percent below that of 1961, and the average value per ton dropped 4 percent, reflecting the continuing trend toward modernization and cost reduction in the bituminous coal industry. A wide variety of coals was produced, including high- and low-volatile coals for domestic and industrial heating and industrial power and a small quantity of semianthracite for domestic heating. A sizable tonnage also was exported. Buchanan County produced over 40 percent of the Virginia coal tonnage, and four of the eight southwestern counties in which production occurred—Buchanan, Dickenson, Wise, and Russell—accounted for 97 percent of the total compared with 95 percent in 1961. Underground production comprised 91 percent of the total, strip mine output 6 percent, and auger mine production 3 percent.

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[11] American Metal Market. B & W Continuous Cast Process in Operation at Roanoke Mill. V. 70, No. 89, May 9, 1963, p. 4.
Pittsburgh Post Gazette. Steel Casting Data Bared. May 8, 1963, p. 33.
[12] Pittsburgh Press. Company to Build Nuclear Laboratory. April 9, 1962, p. 15.

The total number of mines rose to 1,351, 172 more than in 1961. Of this number, 1,274 were underground mines, 44 were strip mines, and 33 were auger mines. Mechanically loaded coal amounted to 40 percent of the total underground output, 77 percent of the mechanically loaded tonnage was by 125 mobile loading machines, 14 fewer than in 1961. Most of the balance of the mechanically loaded coal was cut by 10 continuous mining machines, although a small quantity was hand-loaded on face conveyors. Drilling equipment at underground mines included 859 cutting machines, 1,351 handheld and post-mounted coal drills, 19 mobile drills, and 102 roof and rock drills. Haulage equipment in underground mines included 627 locomotives, 688 rubber-tired tractors, and 8,414 mine cars. Main line rail track totaled 106.2 miles, and all other track, 48.4 miles. Other haulage facilities included 110 shuttle cars, 13 shuttle buggies, and 102 conveyors averaging 2,104 feet in length.

Equipment employed at strip operations comprised 78 power shovels and drag lines of which 71 were diesel-powered, and 75 were of less than 3-cubic-yard capacity. Also used in stripping coal were 65 bulldozers, 17 power drills, and 75 trucks or tractor-trailers. Equipment at auger mines included 35 augers, 1 diesel-powered shovel, 35 bulldozers, 3 power drills, and 35 trucks or tractor-trailers.

Coal mechanically cleaned totaled 12.8 million tons or 44 percent of the total coal produced. Wetwashing other than with jigs was the principal method of treatment, being used for 82 percent of the cleaned coal which was processed in 24 cleaning plants. Coal crushed comprised 34 percent of the total coal mined compared with 28 percent in 1961. Fifteen percent of the total coal produced was treated with dust-laying and antifreezing preparations. Ninety-four percent of the treated coal was prepared with oil and the balance with petroleum asphalt, calcium chloride, and oil and calcium chloride combined.

According to final data the total number of man-hours worked at bituminous coal mines in 1961 was 21,108,726. The average number of men employed was 13,148. There were 30 fatal and 1,006 nonfatal injuries. Injury severity rates per million man-hours for fatal and nonfatal accidents were 1.42 and 47.66, respectively. According to preliminary data, 22 fatalities occurred in 1962.

TABLE 3.—Coal (bituminous) production, by counties
(Thousand short tons and thousand dollars)

County	1961		1962	
	Quantity	Value [1]	Quantity	Value [1]
Buchanan	10,949	$41,072	11,997	$45,179
Dickenson	8,438	34,901	8,356	35,119
Lee	453	1,626	453	1,666
Montgomery	12	41	11	43
Russell	1,935	9,149	2,024	9,461
Scott	17	76	12	61
Tazewell	933	4,981	460	1,500
Wise	7,595	34,275	6,161	24,531
Total	30,332	126,121	29,474	117,560

[1] Value received or charged for coal f.o.b. mine, including selling cost. (Includes value for coal not sold but used by producer, such as mine fuel, and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

Coke.—Only beehive coke was produced in Virginia, and output was confined to Wise County in 1962. Coke was burned by five companies in 667 ovens, of which 180 were Mitchell or rectangular ovens. No slot-type ovens were operated and no byproducts recovered. Construction of a sixth beehive coke plant was started in April at Whitewood, near Vansant, in Buchanan County. The ovens were to be completed by December and placed in operation in early 1963. This plant was to consist of 250 Mitchell nonrecovery-type ovens in three batteries. Two of these batteries, comprising 210 ovens, were to be completed by the end of the year. The coke produced would be shipped to the McLouth Steel Co., Detroit, Mich. The company was expected to consume 250,000 tons annually.

Fuel Briquets and Packaged Fuel.—Wright Coal & Oil Co., Inc., Norfolk, produced packaged fuel prepared from bituminous coal. No fuel briquets were manufactured in Virginia.

Petroleum and Natural Gas.—Production of petroleum and natural gas increased slightly. Output was small and was consumed within a comparatively limited area. Petroleum was produced only from the Rose Hill Field, Lee County. An exploratory program was undertaken near Rose Hill by a major oil company. Seismographic exploration was undertaken for oil and gas in other parts of western Virginia. Three wildcat wells were drilled. According to the American Gas Association, reserves of natural gas at yearend totaled 33,225 million cubic feet, a slight reduction from those of 1961, and were all nonassociated reserves; i.e., free gas not in contact with crude oil in the reservoir.

Natural gas reached consumers through the pipeline facilities of Hope Natural Gas Co., Kentucky-West Virginia Gas Co., and United Fuel Gas Co. Three dry holes were drilled by United Fuel Gas Co. Subsequently, they were plugged and abandoned. A drilling rig near Duffield in Scott County was skidded from its original location to a new site after there was trouble in re-aiming the drill hole at the original location. Trouble developed also in the new hole. This well might be plugged and abandoned also.

Skimming, cracking, and coking facilities were maintained at a petroleun refinery operated by American Oil Co. at Goodwin Neck near Yorktown, York County. Research laboratories were operated by the American Oil Co. at Yorktown and the Texaco Experiment, Inc., at Richmond, Henrico County.

Some seismic prospecting by major oil companies was undertaken in Buchanan, Dickenson, and Lee Counties and other parts of western Virginia where large acreages have been leased in recent years for exploratory work. The Commonwealth of Virginia, through the Virginia Division of Mineral Resources and Aero Service Corp., completed and made available an airborne magnetometer survey of 4,800 square miles in the southwestern part of the State.

NONMETALS

Aplite.—Output of aplite totaled 125,000 long tons valued at $912,000, an increase of 30 percent in tonnage and 40 percent in value. Average value per long ton also increased 9 percent. Four firms

in Amherst, Hanover, and Nelson Counties were the only companies producing aplite which was used entirely in glass manufacture.

Aplite consumed for concrete aggregate, roofing granules and in the manufacture of brick and block is treated in this chapter in the section dealing with stone.

Cement.—Production of portland cement was maintained at a high level during the year and output of masonry cement increased 8 percent over that of 1961. Producing capacity at one of the plants was nearly doubled when a new larger kiln was placed in operation in May. One of the plants used the wet process and the other two plants the dry process of manufacturing cement. Three plants manufactured both portland and masonry cement. One company in Warren County produced masonry cement only. Calcareous marl, limestone, and shale were mined for captive use by these companies. Sand, gypsum, millscale and pyrite cinders, various air-entraining compounds, and certain grinding aids used in the manufacturing process were purchased. General-use and moderate-heat cement (Types I–II) was the principal type of portland cement manufactured and marketed. High-early-strength cement also was produced, and a sizable quantity of air-entrained cement was shipped. Shipments were mainly by railroad, but some cement was shipped by truck and boat or barge. Bulk shipments comprised most of the sales, and the remainder was shipped in paper bags.

The distribution of portland cement by types of consumer was as follows: 64 percent to ready-mixed concrete companies (52 percent in 1961); 14 percent to contractors, including highway contractors (15 percent in 1961); 13 percent to concrete product manufacturers (20 percent in 1961); 7 percent to building material dealers (10 percent in 1961); and the remainder to Federal, State, and local government agencies, and miscellaneous customers. Portland cement shipments largely were made in Virginia, and to North Carolina and West Virginia. Most of the masonry cement was shipped in Virginia and to North Carolina, the District of Columbia, and Maryland. Smaller shipments were made to many other States, including southern and New England destinations.

Clays.—Increased building in Virginia led to a new record in both quantity and value of clay output. Production rose 4 percent in quantity and 3 percent in value over the previous record years, 1961 for quantity and 1959 for value. Miscellaneous clay or shale was the only type of clay produced, and slightly over half of the output was consumed in making building brick. The principal uses for the balance were lightweight aggregate and portland cement. Other uses included vitrified sewer pipe, flue linings, and other heavy clay products. Clay was mined by 16 companies at 21 pits in 16 counties. The principal producing counties, in descending order of value of output, were Botetourt, Nansemond, Prince William, and Chesterfield. A description of the clay products plants in Virginia included discussions of individual plants, raw materials, and manufacturing processes.[13]

[13] Wood, Robert S. Structural Clay Products Industry. Virginia Minerals, v. 8, No. 2, May 1962, pp. 1–7.

TABLE 4.—Clays sold or used by producers

Year	Short tons	Value	Year	Short tons	Value
1953-57 (average)	897,265	$908,636	1960	1,347,766	$1,394,665
1958	1,152,850	1,143,160	1961	1,406,201	1,332,165
1959	1,346,014	1,396,433	1962	1,464,417	1,443,927

Feldspar.—Production of feldspar from three mines in Bedford County was 2 percent higher in quantity and 16 percent higher in value than in 1961. Average value per ton increased $1 over that of 1961. The three mines were operated by one company which produced potash and mixed feldspar for grinding in its own mill at Bedford. Ground feldspar was consumed mainly in the manufacture of pottery and enamel, and minor quantities were used in abrasives, as welding-rod coating, and as brick facing. The ground feldspar was consumed primarily in Maryland, Ohio, and New Jersey, and smaller quantities were consumed in other eastern and midwestern States.

Gem Stones.—Mineral collectors obtained a variety of gems and mineral specimens from various Virginia counties. Included were amazonite and cleavelandite in Amelia County, kyanite and hematite in Buckingham County, moonstone in Hanover County, and unakite in Rockbridge County.

Gypsum.—United States Gypsum Co. mined crude gypsum at Plasterco in Washington County and produced calcined gypsum and plasterboard and other gypsum products at a plant nearby. The new underground gypsum mine in Smyth County continued under development and did not reach the production stage by yearend. Calcined domestic and imported gypsum also was produced by this company at a mill in Norfolk. Crude gypsum from Nova Scotia was ground by several firms in the Norfolk area for use as a land dressing, especially by peanut farmers.

Kyanite.—Sales of refined kyanite increased 3 percent over those of 1961. Crude ore output was slightly less than in 1961. Kyanite Mining Corp. operated two mines and accompanying flotation plants, one in Buckingham County and the other in Prince Edward County. A pulverizing mill primarily for grinding kyanite for special ceramic purposes was operated in Appomattox County. The chief market for this minreal was for refractory and other ceramic purposes.

Lime.—Output of lime decreased 6 percent in quantity and the value was 4 percent greater than in 1961. There was an 11 percent increase in average value per ton. Quicklime comprised 90 percent of the total production and hydrated lime the balance. Chemical and industrial uses, including both quicklime and hydrated lime, totaled 95 percent of all the lime sold or used. Output of chemical and building lime decreased and agricultural lime increased 8 percent compared with 1961. Ten companies burned lime in seven counties. Two companies near Norfolk calcined shell to lime. Giles, Smyth, and Shenandoah Counties were the chief lime-burning counties. Fuels for burning lime included natural gas, bituminous coal, and coke. Pot, shaft, and rotary kilns and batch and continuous hydrators were used in lime manufacturing.

Uses for the quicklime included manufacture of calcium carbide, paper, whiting, and alkalies, as a flux in steel manufacture, and as

a soil conditioner in agriculture. The principal markets for the hydrated lime included the purification of water, the tanning of leather, the treating of sewage and trade wastes, construction, and agricultural purposes.

TABLE 5.—Lime sold or used by producers, by uses

Year	Agricultural		Building		Chemical and other industrial		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1953–57 (average)	[1] 20,608	$269,008	[1] 8,382	$88,844	[1] 453,306	$4,954,511	487,879	$5,312,363
1958	[2]	[2]	[2]	[2]	438,449	5,119,929	471,313	5,532,833
1959	29,519	351,955	5,345	73,628	730,376	7,742,829	765,240	8,168,412
1960	27,011	319,829	5,541	82,753	678,487	7,625,404	711,039	8,027,986
1961	28,760	375,489	4,932	72,584	[3] 623,075	[3] 6,926,661	[3] 656,767	[3] 7,374,734
1962	31,104	426,476	2,816	40,629	580,593	7,201,198	614,513	7,668,303

[1] Four year average. Excludes 1957 production to avoid disclosing individual company confidential data; included in total.
[2] Figure withheld to avoid disclosing individual company confidential data; included in total.
[3] Revised figure.

Mica.—No sales of crude mica were reported. Richmond Mica Corp., Newport News, processed North Carolina and Indian scrap mica for sale to rubber, paint, wallpaper, and plastics manufacturers, and for other purposes. The factory scrap and mine scrap purchased for grinding were wet ground at the company mill.

Nitrogen Compounds.—Chiefly for use in fertilizer, nitrogen compounds were manufactured by Allied Chemical Corp., Nitrogen Division, Hopewell, Prince George County. Other products manufactured for sale included ammonia, urea solution, and ammonium sulfate.

Perlite.—A firm at Hopewell, Prince George County, expanded perlite purchased in Colorado. Sales were somewhat less than in 1961. The perlite was consumed in building plaster, concrete aggregate, and soil conditioning.

Pyrites.—Mining of pyrites (pyrrhotite) at the Gossan mine in Carroll County was discontinued the first part of March.

Salt.—Recovery of salt brine by a firm at Saltville, Smyth County, increased slightly over that of 1961. Chief uses were the manufacture of chlorine, soda ash, and other chemicals.

Sand and Gravel.—Production of sand and gravel remained at a high level, only 1 percent less than the record year 1961. Value of sand and gravel production, however, rose 11 percent to a new high, $16.4 million. This increase in value was caused primarily by a 27 percent increase in the average value of commercial gravel. Paving and building uses comprised 80 percent of the commercial production (48 percent paving, 32 percent building). Other types of sand and gravel included glass sand, molding sand for steel plants and foundries, engine sand, filtration, railroad ballast, fill, and miscellaneous sand, including sand for traction on ice. Gravel comprised 50 percent of the total output and 59 percent of the total value. The average value per ton rose to $1.68, a rise which was due almost entirely to higher prices paid for commercial gravel. Production was reported from 37 counties. Commercial output comprised 99 percent of the total production and 87 percent was washed, screened, or

otherwise prepared. The small remainder was State, Federal, and local government output, which was all processed. Sixty-three commercial producers operated 71 sand and/or gravel pits. Of the reported commercial production, 65 percent was transported by truck, 11 percent by railroad, and 24 percent by waterway. The last figure was significant and partially reflected the influence of the Chesapeake Bay Bridge-Tunnel project. The counties leading in production of commercial sand and gravel were Fairfax, Henrico, Chesterfield, Princess Anne, and Prince George. The output of these five counties alone comprised 78 percent of the tonnage and 79 percent of the value of Virginia commercial sand and gravel production.

TABLE 6.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1961		1962	
	Short tons	Value	Short tons	Value
Commercial operations:				
Sand:				
Building	1,516,508	$2,112,447	1,546,599	$2,251,096
Paving	2,067,742	3,097,175	1,945,967	2,476,029
Engine	35,940	46,731	50,392	108,503
Fill	282,650	147,742	618,840	247,978
Ground	189	758	(1)	(1)
Other [2]	335,966	816,607	620,843	1,650,970
Total	4,238,995	6,221,460	4,782,641	6,734,576
Gravel:				
Building	1,868,146	2,935,594	1,542,175	3,149,873
Paving	2,693,790	4,760,018	[3] 3,120,167	[3] 6,311,804
Fill	(1)	(1)	175,000	98,750
Other	[4] 767,009	[4] 598,603	(1)	(1)
Total	5,328,945	8,294,215	4,837,342	9,560,427
Total sand and gravel	9,567,940	14,515,675	9,619,983	16,295,003
Government-and-contractor operations:				
Sand:				
Paving	95,982	40,739	52,645	5,937
Other	18,191	7,276	22,266	8,906
Total	114,173	48,015	74,911	14,843
Gravel:				
Paving	145,385	115,612	49,709	64,849
Other	12,000	18,000	----------	----------
Total	157,385	133,612	49,709	64,849
Total sand and gravel	271,558	181,627	124,620	79,692
All operations:				
Sand	4,353,168	6,269,475	4,857,552	6,749,419
Gravel	5,486,330	8,427,827	4,887,051	9,625,276
Total	9,839,498	14,697,302	9,744,603	16,374,695

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes glass sand, molding sand, railroad ballast, filtration sand, and ground sand (1962).
[3] Includes other gravel.
[4] Includes fill.

Soapstone.—Two companies mined, crushed, and ground soapstone. One company was in Franklin County and the other company in Nelson and Albemarle Counties. Output of ground soapstone decreased considerably compared with 1961. The principal uses were in roofing, rubber, foundry facings, and insecticides. Soapstone used as dimension stone is discussed in the following section of this chapter.

Stone.—Continued active highway and building construction resulted in new records in tonnage and value of stone, the second most im-

portant mineral commodity produced in Virginia. Production of stone rose 12 percent in quantity and 10 percent in value over the previous record year 1961. Contributing substantially to the new record were large increases in output of granite riprap, crushed and broken stone for concrete and roadstone, and a 13 percent rise in output of limestone. Increases in limestone consumption included large rises for riprap, fluxing stone, and railroad ballast. Of the total production, 69 percent was consumed as concrete aggregate and for highway construction, 9 percent for cement, and 5 percent each for lime and metallurgical flux. Types of stone produced in Virginia included limestone, granite, basalt, sandstone, marble, miscellaneous stone (including soapstone, greenstone, and aplite), calcareous marl, slate, and shell. A byproduct of the oyster and mollusk industries, shell was consumed chiefly as an agricultural liming material and in lime manufacture. Roofing granules were prepared from slate by one firm in Buckingham County and from crushed and broken aplite by two companies in Nelson County. Of the total stone produced, 61 percent was limestone, 25 percent was granite, and 11 percent was basalt. Crushed and broken stone comprised most of the production by far. The remainder consisted of small quantities of dimension sandstone and miscellaneous dimension stone. Measured by tonnage, the principal stone producing counties were Botetourt, Loudoun, Washington, Roanoke, and Frederick. Commercial stone was quarried in 51 counties by 113 producers. Six State or municipal agencies in 11 counties produced Government-and-contractor stone. Three firms in three counties produced and marketed shell. Varieties of commercial stone by number of stone producers were as follows: Limestone, 54 companies (69 quarries); granite, 13 companies (18 quarries); basalt, 9 companies (9 quarries); sandstone, 10 companies (10 quarries); marble, 1 company (1 quarry); miscellaneous stone, 4 companies (4 quarries); calcareous marl, 3 companies (3 quarries); and slate, 3 companies (3 quarries). The number of quarries does not add to the total shown because six firms produced more than one kind of stone.

TABLE 7.—Stone sold or used by producers, by kinds and uses

Kind and use	1961		1962	
	Short tons	Value	Short tons	Value
Dimension stone: Sandstone, all uses	239	$3,475	1,191	$12,159
Crushed and broken stone:				
Granite:				
Concrete and roadstone	4,637,652	7,245,035	5,742,998	8,963,610
Riprap	[1] 575,317	[1] 1,095,510	[2] 739,406	[2] 1,453,822
Basalt: Concrete and roadstone	[2] 2,777,172	[2] 4,361,328	2,709,440	4,641,231
Limestone:				
Riprap	5,976	7,760	103,628	128,042
Fluxing stone	972,454	1,697,462	1,245,544	2,107,113
Concrete and roadstone	8,013,598	10,934,629	9,047,856	11,963,629
Railroad ballast	260,516	326,758	410,813	558,051
Agricultural	875,293	1,785,132	899,925	1,721,926
Miscellaneous	3,777,122	6,061,073	3,988,422	6,460,537
Sandstone: All uses	515,225	925,425	291,794	494,445
Shell: Miscellaneous uses	14,460	88,375	(3)	(3)
Undistributed [4]	508,214	4,673,337	584,576	4,616,149
Total	22,933,638	39,206,199	25,765,593	43,120,714

[1] Includes railroad ballast and miscellaneous uses.
[2] Includes railroad ballast.
[3] Included in "Undistributed."
[4] Includes dimension and crushed and broken miscellaneous stone and slate, crushed and broken calcareous marl and marble, and shell (1962).

Sulfur.—American Oil Co. recovered hydrogen sulfide from fuel gas and converted it to sulfur at its Yorktown refinery in York County. Production and shipments were both higher than in 1961, but the value of shipments declined.

METALS

Ferroalloys.—E. J. Lavino & Co. manufactured ferromanganese at two blast furnaces at Reusens near Lynchburg, Campbell County, until June 22 when the plant closed down.

Iron and Steel.—Newport News Shipbuilding & Drydock Co. and Roanoke Electric Steel Corp. produced ingot and casting steel at Newport News and Roanoke, respectively. Roanoke Electric Steel Corp. installed a continuous process casting machine in December for making molten steel into bars for the production line. This machine, which had been under development by Babcock & Wilcox for 15 years, was believed to be the first commercial one placed in operation in the United States. Full plant production was expected in the early part of 1963.[14]

Iron Ore (Pigment Material).—Sienna, umber, ocher, and other natural red and yellow iron oxide pigments and a wide variety of finished iron oxide pigments were produced by a firm in Pulaski County near Hiwassee and Pulaski. Natural red iron oxide and finished natural and manufactured pigments were produced for sale near Henry in Franklin County by another company. Production of iron oxide pigment material nearly doubled compared with 1961.

Lead and Zinc.—Production of recoverable zinc showed a 9 percent decrease from 1961, the record year. The tonnage was only slightly less than in the second highest year, 1938, although the value was 16 percent higher than in 1957, the previous peak value year. Zinc was produced from two mines in Wythe County and one operation in Rockingham County. Output of recoverable lead rose to the highest production since 1954. The value showed a small decrease because of an 11 percent drop in the average value per pound. Zinc-lead ores from Wythe County were processed at a mill at Austinville, and zinc ore from Rockingham County was concentrated at Timberville. Zinc concentrates were shipped for treatment to Josephtown and Palmerton, Pa., and to East Chicago, Ind. Lead concentrate was shipped to Palmerton, Pa., Baton Rouge, La., and Japan.

TABLE 8.—Mine production of recoverable silver, lead, and zinc

Year	Silver		Lead		Zinc	
	Troy ounces	Value	Short tons	Value	Short tons	Value [1]
1953–57 (average)	1,682	$1,522	3,257	$931,826	18,804	$4,483,583
1958	2,023	1,831	2,934	686,556	18,472	3,807,853
1959	866	784	2,770	637,100	20,334	4,661,792
1960			2,152	503,568	19,885	5,142,275
1961			3,733	768,998	29,163	6,726,462
1962			4,059	746,856	26,479	6,140,705

[1] Recoverable zinc valued at the yearly average price of prime western slab zinc, East St. Louis market. Value established after transportation, smelting, and manufacturing charges have been added to the value of ore at the mine.

[14] American Metal Market. B. & W. Continuous Cast Process in Operation at Roanoke Mill. V. 70, No. 89, May 9, 1963, p. 4.
Pittsburgh Post Gazette. Steel Casting Data Bared. May 8, 1963, p. 33.

Manganese.—A new plant for milling and packaging approximately 20,000 tons of imported manganese ore per year was completed and placed in full operation at Newport News in December by Union Carbide Ore Co. This plant included ore drying, crushing, and grinding equipment, and the finely ground product was to be shipped to other Union Carbide plants in the United States and abroad chiefly for use in manufacturing batteries.[15]

Titanium Concentrate.—Output of titanium concentrate was only slightly less than in 1961, although the value increased sharply. Production of ilmenite decreased moderately, and production of rutile more than doubled. Ilmenite was produced by American Cyanamid Co. at Piney River, Amherst County, and M. & T. Chemicals, Inc. (formerly Metal & Thermit Corp.), at a plant near Montpelier, Hanover County. Rutile was produced only by M. & T. Chemicals, Inc. Ilmenite was primarily used in the manufacture of titanium dioxide pigments. The principal market for rutile was for welding rod coating. Studies of titanium ore and resources in Nelson and Amherst Counties have indicated several possible deposits warranting further consideration for economic development. A number of potential sites for development also were located in the Roseland anorthosite region in Nelson County. Beneficiation tests were conducted by the Bureau of Mines on ore from this locality.[16]

TABLE 9.—Value of mineral production in Virginia, by counties [1]

County	1961	1962	Minerals produced in 1962, in order of value [2]
Accomack	$20,042	$28,172	Sand and gravel.
Albemarle	(3)	(3)	Stone, sand and gravel.
Alexandria (City)		(3)	Sand and gravel.
Alleghany	(3)	(3)	Stone.
Amelia	(3)	(4)	Gem stones.
Amherst	(3)	(3)	Titanium concentrate, aplite, sand and gravel, stone.
Appomattox	63,410	75,662	Stone.
Arlington		(3)	Sand and gravel.
Augusta	(3)	(3)	Cement, stone, clays.
Bath	129,127	(4)	Stone.
Bedford	(3)	(3)	Stone, feldspar.
Bland	5,498	8,241	Stone.
Botetourt	(3)	(3)	Cement, stone, clays, sand and gravel.
Brunswick	(3)	(4)	Stone, clays.
Buchanan [5]	41,107,650	45,178,753	Coal, natural gas.
Buckingham	2,116,551	2,278,130	Stone, kyanite, clays, sand and gravel, gem stones.
Campbell	1,410,628	1,393,994	Stone.
Caroline	(3)	(3)	Sand and gravel.
Carroll	(3)	(3)	Pyrites.
Chesterfield	(3)	(3)	Sand and gravel, stone, clays.
Clarke	115,025	(3)	Stone.
Craig	(3)	(4)	Sand and gravel.
Culpeper	(3)	(3)	Stone, sand and gravel.
Dickenson [5]	34,901,399	35,124,727	Coal, sand and gravel, natural gas.
Dinwiddie	(3)	(3)	Stone, sand and gravel, clays.
Fairfax	5,105,868	5,626,859	Sand and gravel, stone.
Fauquier	638,242	(3)	Stone.
Fluvanna		(4)	Do.
Franklin	(3)	(3)	Soapstone.
Frederick	[6] 3,085,643	3,220,508	Stone, lime, sand and gravel, clays.
Giles	(3)	(3)	Lime. stone.

See footnotes at end of table.

[15] American Metal Market, U.C.O.C. Adds New Ore Grinding Plant. V. 69, No. 233, Dec. 6, 1962, p. 15.

[16] Fish, George E., Jr. Titanium Resources of Nelson and Amherst Counties, Va. (in Two Parts) 1. Saprolite Ores. BuMines Rept. of Inv. 6094, 1962, 44 pp.
Swanson, V. F., and J. E. Shelton. Flotation of Titanium Minerals From the Roseland Anorthosite, Near Roseland, Nelson County, Va. BuMines Rept. of Inv. 5953, 1962, 21 pp.

TABLE 9.—Value of mineral production in Virginia, by counties [1]—Continued

County	1961	1962	Minerals produced in 1962, in order of value [2]
Goochland	$928,500	(3)	Stone.
Grayson		$88,260	Do.
Greensville	(3)	(3)	Do.
Halifax		(3)	Do.
Hanover	(3)	1,301,985	Stone, aplite, titanium concentrate, gem stones.
Henrico	4,313,706	4,630,641	Sand and gravel, stone.
Henry	(3)	(3)	Stone.
Highland	27,667	(4)	Do.
Isle of Wight	(3)	[7] 90,584	Lime, stone, sand and gravel.
King William	(3)	(3)	Sand and gravel.
Lee [8]	1,998,449	2,126,069	Coal, stone, petroleum.
Loudoun	2,608,786	3,211,042	Stone, sand and gravel.
Louisa	(3)	(3)	Stone.
Madison		(4)	Do.
Mecklenburg	(3)	(3)	Do.
Montgomery	329,886	[9] 274,044	Stone, coal, clays.
Nansemond	(3)	(3)	Stone, clays.
Nelson	(3)	(3)	Stone, aplite, gem stones.
Norfolk	(3)	(3)	Cement, lime, sand and gravel, stone.
Northampton	(3)	84,065	Sand and gravel.
Northumberland	12,500		
Nottoway	365,000	(3)	Stone.
Orange	(3)	(3)	Clays.
Patrick	(3)		
Pittsylvania	(3)	(3)	Stone, sand and gravel.
Prince Edward	(3)	(3)	Kyanite, sand and gravel.
Prince George	1,041,061	890,240	Sand and gravel.
Prince William	(3)	(3)	Clays, stone.
Princess Anne	644,196	460,161	Sand and gravel.
Pulaski	(3)	(3)	Stone, iron ore (pigment material).
Roanoke	(3)	[9] 1,935,163	Stone, clays.
Rockbridge	1,007,453	(3)	Sand and gravel, stone, clays, gem stones.
Rockingham	2,117,476	2,221,743	Zinc, stone, sand and gravel.
Russell [10]	9,166,828	9,461,486	Coal, stone, clays.
Scott	[11] 76,261	1,059,932	Stone, coal.
Shenandoah	(3)	(3)	Stone, lime.
Smyth	(3)	(3)	Lime, salt, stone, sand and gravel, clays.
Spotsylvania	(3)	(3)	Sand and gravel, stone.
Stafford	(3)	(3)	Sand and gravel.
Surry	(3)		
Sussex		82,705	Sand and gravel.
Tazewell [10]	5,045,878	1,569,685	Coal, stone, lime, clays.
Warren	(3)	(3)	Cement, stone, sand and gravel.
Washington	(3)	3,311,512	Stone, gypsum, sand and gravel.
Westmoreland	105,000	72,500	Sand and gravel.
Wise [11]	34,274,928	24,532,583	Coal, stone, sand and gravel.
Wythe	6,634,926	6,152,873	Zinc, lead, stone, sand and gravel.
York	(3)	364,408	Sand and gravel.
Undistributed [12]	[6] 65,901,200	65,637,698	
Total	[6] 225,298,000	222,494,000	

[1] The following counties did not report production: Charles City, Charlotte, Cumberland, Essex, Floyd, Gloucester, Greene, James City, King and Queen, King George, Lancaster, Lunenberg, Mathews, Middlesex, New Kent, Page, Powhatan, Rappahannock, Richmond, and Southampton.
[2] Value of natural gas and petroleum included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Included with "Undistributed."
[5] Excludes natural gas; included with "Undistributed."
[6] Revised figure.
[7] Excludes sand and gravel; included with "Undistributed."
[8] Excludes petroleum; included with "Undistributed."
[9] Excludes clay; included with "Undistributed."
[10] Excludes stone and clays; included with "Undistributed."
[11] Excludes stone; included with "Undistributed."
[12] Includes value of natural gas and petroleum; part of value of gem stones, and sand and gravel (1961) and values indicated by footnote 3. Also includes value of certain quantities of Government-and-contractor limestone and commercial sandstone for which separate data by counties were not available.

REVIEW BY COUNTIES

Seventy-eight of the 98 counties and 1 independent city reported output of minerals. Production of stone was reported from 56 counties and output of sand and gravel came from 36 counties and 1 independent city. The Virginia Department of Highways produced Government-and-contractor sand and gravel in Accomack, Henrico,

and Pittsylvania Counties. Sand and gravel for paving also was mined by Henrico County Highway Department. All Government-and-contractor sand and gravel was prepared material and was used mainly for paving and maintenance of roads and streets.

The Virginia Department of Highways also produced limestone in Augusta, Bath, Clarke, Highland, Roanoke, and Russell Counties for highway construction and road repair. Crushed granite was produced by the cities of Martinsville, Henry County, and Danville, Pittsylvania County, and crushed limestone was quarried and prepared by the city of Wytheville, Wythe County, for concrete aggregate and roadstone.

Accomack.—Two sand and gravel plants were operated. Charles F. Mathews, General Contractors, produced washed and screened building and paving sand and paving gravel at a dredging operation at Oak Hall. Lance J. Eller, Inc., mined sand which was processed for building and paving purposes at a stationary plant near Mappsville.

Albemarle.—Superior Stone Co., Division of Martin-Marietta Corp., produced granite at its Red Hill quarry. Late in 1962, this quarry employed 30 men and was being mined on five benches varying from 50 to 140 feet in height. About 10 feet of overburden was removed, and the pit was 330 feet deep. Charlottesville Stone Corp., near Charlottesville, quarried basalt for concrete aggregate and roadstone. The quarry employed 15 men and was developed by a multiple bench system with each bench being about 50 feet thick; overburden removed totaled about 30 feet in thickness. S. L. Williamson Co., Inc., produced bank-run sand for paving purposes near Charlottesville. Another small producer sold sand for road construction and use on ice.

Alexandria (City).—A small quantity of sand was mined in the City of Alexandria and processed for road paving and use on ice.

Alleghany.—Low-magnesium limestone was quarried by W. G. Mathews, Jr., Inc., near Lowmoor and Clifton Forge, for use as concrete aggregate, roadstone, and agstone.

Amelia.—Mineral collectors gathered amazonite and cleavelandite from the vicinity of Amelia Court House and other locations in the county.

Amherst.—American Cyanamid Co. produced ilmenite near Piney River. This mineral, mined by open-pit methods, was consumed at the company's titanium-pigment plant in Nelson County.

Aplite was quarried by Riverton Lime & Stone Co., Division of Chadbourn Gotham, Inc., near Piney River. This material, which was processed in Nelson County, was used in glass manufacture, as concrete aggregate and roadstone, and for roofing granules. Sand for building was dredged and processed near Lynchburg by the Smiley Sand Co.

Appomattox.—Limestone was quarried and processed for agricultural stone by the Virginia Department of Agriculture and Immigration at its No. 2 grinding plant near Appomattox. Kyanite concentrate from its Dillwyn and Cullen plants was ground for special applications by Kyanite Mining Corp. at Pamplin.

Arlington.—Sidney R. Johnston opened a portable operation at Bancroft where gravel was produced for road construction.

Augusta.—Lehigh Portland Cement Co. mined shale and limestone for captive use in the manufacture of cement at Fordwick. General-use and high-early-strength portland cements were produced by the dry process in six kilns. A sizable quantity of masonry cement also was also produced. Electric power was both generated and purchased. In addition to the limestone and shale mined, material purchased for use in making cement included gypsum, mill scale and pyrite cinders, air-entraining compounds, and grinding aids.

Limestone for concrete aggregate and roadstone was quarried, crushed, and sold by Belmont Trap Rock Co., Inc., Augusta Stone Corp., and Valley Stone Co., all near Staunton. The Middle River plant of Augusta Stone Corp. was idle during 1962. Limestone for agricultural purposes was quarried and ground by the Virginia Department of Agriculture and Immigration No. 1 grinding plant near Staunton.

North Mountain Brick of Virginia, formerly North Mountain Brick Co., Inc., which had been inactive for several years, began operations under new management in October. The firm mined shale to make building brick.

Bath.—Salem Stone Corp. produced a small quantity of limestone for concrete from a new quarry near Hot Springs.

Bedford.—Blue Ridge Stone Corp. quarried limestone near Blue Ridge. The limestone was used as concrete aggregate, roadstone, railroad ballast, and stone sand. Potash and mixed feldspar was mined at the Clinchfield Sand & Feldspar Corp. Mitchell, Peakesville, and Overacre mines. The feldspar was ground in the company mill at Bedford and shipped mainly to pottery and enamel manufacturers. Smaller quarries were consumed in soaps, abrasives, welding rods, and for brick facing. Feldspar was shipped principally to Maryland, Ohio, and New Jersey.

Bland.—Limestone for riprap was quarried by Bland Correctional Farm near White Gate.

Botetourt.—Again the leading limestone producing county was Botetourt. Output of limestone rose to 1.9 million short tons valued at $2.9 million, an increase of 12 percent in quantity and 10 percent in value over 1961. Two quarries were operated by Liberty Limestone Corp. and one by James River Hydrate & Supply Co. near Buchanan. The limestone was crushed and ground for concrete aggregate, roadstone, metallurgical flux, filler for asphalt and fertilizer, coal mine dust, mineral food for animals, railroad ballast, stone sand, and for agstone. Salem Stone Corp. quarried, crushed, and stockpiled a sizable quantity of limestone using a portable plant. No sales were reported.

Lone Star Cement Corp. quarried limestone for its own use in cement manufacture at its Cloverdale Plant, where general-use and high-early-strength portland cements were produced by the dry process in four 9- by 340-foot rotary kilns. Most of the production and shipments was non-air-entrained. A large tonnage of masonry cement also was shipped. All electrical energy for this plant was purchased. This was the largest cement plant in Virginia, but shipments were slightly less than those in 1961.

The Lone Star Cement Corp. limestone quarry employed 44 men in the pit, on a one-shift-per-day basis, 5 days per week. The lime-

stone quarry was developed as a multiple-bench operation with benches from 25 to 75 feet thick. The shale pit was worked as a single bench 100 to 150 feet thick. The limestone and shale deposits were 600 feet thick, and the overburden varied from 7 to 70 feet in thickness. The rock was hauled from the mine to the crushing plant by diesel-powered trucks. Primary drilling was done by diesel-powered rotary drills, secondary drilling was with jack-hammers or air-track drills, and all drilling was dry. Primary blasting was done at 15-day intervals and secondary blasting almost daily.

Total output of clay in Botetourt County, the second largest clay producing county in the State, again declined slightly in both quantity and value. Webster Brick Co., Inc., and Virginia Lightweight Aggregate Corp. mined miscellaneous clay and shale for heavy clay products and lightweight aggregate, respectively, at Webster, near Roanoke. Two small producers sold unprocessed gravel for road stabilization.

Brunswick.—Granite was quarried and prepared for use as concrete aggregate, roadstone, and riprap by Southern Materials Co., Inc., at its Rawlings quarry. Miscellaneous clay was mined by Brick & Tile Corp. near Lawrenceville for manufacturing building brick.

Buchanan.—The county was the chief coal-producing county. Its output totaled 41 percent of the Commonwealth total. There were 790 active underground mines and 18 strip and auger mines. Virtually all of the output (97 percent) was from underground mines. Production was 10 percent greater than in 1961. Equipment used at underground mines included 817 handheld and postmounted coal drills and 25 rock drills. Haulage equipment included 347 locomotives, 517 rubber-tired tractors, 5,038 mine cars, 10 shuttle cars, 3 shuttle buggies, and 7 conveyors. A total of 477 cutting machines was used. Track mileage comprised 38.9 miles of mainline and 18.2 miles of other track. Equipment used in the 6 strip mines included 12 diesel-power shovels and 6 bulldozers. A total of 12 augers, 14 bulldozers, 1 power drill, and 7 trucks or tractor-trailers was employed at 12 auger mines. The chief producers in the county included Harmon Mining Corp., Island Creek Coal Co., Jewell Ridge Coal Corp., Black Diamond Coal Co., Buchanan County Coal Corp., and Triple A Coal Co. Principal coal seams mined included Red Ash, Jewell, Jewell Ridge, and Splashdam.

After 15 months of drilling, the Beatrice Pocahontas Co. (jointly owned by Republic Steel Corp. and Island Creek Coal Co.) reached a 55-inch seam of metallurgical coal at a depth of 1,342 feet early in December. This mine at Keen Mountain near Grundy was one of the deepest mines ever sunk in North America to reach coal. It was expected that the 20-foot diameter shaft would handle a production of 1.2 million tons of Pocahontas No. 3 coal. The coal bed was believed to cover a 117-square mile area. Seven additional mines were expected to be sunk to recover the coal in this region.[17]

In April, Jewell Smokeless Coal Corp. began to construct three batteries of coke ovens, consisting of 250 Mitchell nonrecovery-type

[17] Mining Equipment News (Knoxville, Tenn). Deepest Shaft Ever Sunk To Reach Coal. V. 15, No. 1, January 1963.
The Pittsburgh Press. Deepest Mine Hits Steel Coal at 1,342 feet. Dec. 2, 1962.

ovens, at Whitewood near Vansant. Two hundred and ten of these ovens were scheduled for completion by December. Production was to begin in early 1963. The ovens were located near the No. 2 preparation plant of the company. They were expected to consume 360,000 short tons of coal annually in making 250,000 tons of coke for McLouth Steel Co., Detroit, Mich. These were rectangular or horizontal slot-type internal-combustion ovens. A detailed description was published with photographs of the new mine-site ovens, the thin seam mining of the coal, transportation equipment, and the washing, drying, and other treatment facilities at the No. 2 preparation plant.[18]

Natural gas production by United Producing Co., Inc. and United Fuel Gas Co. was delivered to the pipelines of the Hope Natural Gas Co. and the Atlantic Seaboard Corp. The United Fuel Gas Co. sunk and completed three wells with a total footage of 15,394 feet. All these were dry holes and were plugged and abandoned.

Buckingham.—Roofing, structural and sanitary slate, and flagging were prepared at mills near Arvonia by Arvonia-Buckingham Slate Co., Inc., and LeSueur-Richmond Slate Corp. Some slate was sold for granules and miscellaneous purposes. A considerable increase in value of sales was realized because of the greater demand for larger slate panels and other products. The LeSueur-Richmond Slate Corp. quarry was an open pit employing 15 men, 6 days per week, on a one-shift basis. A multiple bench system of mining was used with benches 14 feet wide. Overburden ranged from 50 to 75 feet in thickness. The slate was raised from the pit by means of six inclined cableways and conveyed to the cutting building where it was sized and split. Blue Ridge Slate Corp. quarried and crushed slate for roofing granules at its Dutch Gap quarry near New Canton.

Kyanite was produced by Kyanite Mining Corp. at its Willis Mountain mine. Kyanite was processed at the Dillwyn mill for sale to manufacturers of refractories and other ceramics. This firm also produced and processed engine, building, and beach sand at its Willis Mountain property. Sand was a new product for this company. A hard slaty shale mined at Bremo Bluff by Solite Corp. was used in making lightweight aggregate at a seven-kiln plant. Jasper, kyanite, pink feldspar, hematite, quartz, and tourmaline were included among the mineral specimens found by collectors at various locations in the county.

Campbell.—Rockydale Stone Service Corp. at Concord, and Blue Ridge Stone Corp., near Lynchburg, quarried and crushed limestone for concrete aggregate and roadstone. Dressed building stone, dimension oven hearthstone, irregularly-shaped flagging, and rubble were prepared from rock quarried near Lynchburg by Virginia Greenstone Co., Inc. Some waste or scrap stone was marketed for road fill and walks.

Caroline.—Paving sand and gravel was mined and processed by the Mattaponi Sand & Gravel Co., Inc., at its stationary plant near Point Eastern. A small quantity was also prepared for building use. Building sand was washed and screened by Torrence & Wright at a stationary plant near Milford.

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[18] Coal Age. Better Preparation, On-Site Coking: Keys to Jewell Smokeless Expansion. V. 67, No. 11, November, 1962, pp. 66–67, 72–74, 76 (see also front cover).

Carroll.—Lump and fine pyrrhotite concentrate (pyrites) was produced at the Gossan Mine near Galax by General Chemical Div., Allied Chemical Corp. The product was used in the manufacture of sulfuric acid at the company's Pulaski plant. This operation was shut down March 3.

Chesterfield.—Sand and gravel production declined 12 percent from 1961, but Chesterfield County still ranked third among sand and gravel producing counties. Sand and gravel was dredged and prepared for building and paving purposes by the Southern Materials Co., Inc., at the Kingsland Reach plant. A large quantity of gravel was also used for soil aggregate. Bowles & Jackson quarried and shipped riprap from the Tidewater Crushed Stone Co. quarry site for use in the Chesapeake Bay Bridge-Tunnel project.

Redford Brick Co., and General Shale Products Corp., Southside Division (formerly Southside Brick Works, Inc.), produced miscellaneous clay near Richmond for making building brick and tile. General Shale Products Corp. purchased Southside Brick Works in June and thereafter operated the plant. Daniels Brick & Tile Co., Inc., produced miscellaneous clay from the Dallas Coons clay pit for manufacturing vitrified sewer pipe, tile, and other heavy clay products. Richmond Clay Products Corp. was out of business.

Clarke.—J. C. Digges and Sons, White Post, and Elmer Kenney Lime Co., Millwood, near Berryville, mined pulverized and air-dried calcareous marl for agricultural use. Elmer Kenney Lime Co. ceased operation in October. Crushed limestone was produced by Stuart M. Perry, Inc., for concrete aggregate, roadstone, and agstone at a portable plant near Berryville.

Craig.—Castle Sands Co. mined and processed building and industrial sand at a stationary plant near New Castle. No sandstone was crushed by this company during the year. Only natural sand was produced.

Culpeper.—Culpeper Stone Co., Inc., crushed sandstone for concrete aggregate and roadstone at a quarry near Culpeper. A small quantity of sand was mined and sold for road construction and use on ice.

Dickenson.—Output of bituminous coal decreased slightly, but the county maintained its relative position among the coal-producing counties. Eighty-three mines were operated, including 73 underground mines, 8 strip mines, and 2 auger mines. Drilling equipment used included 105 postheld and postmounted drills, 19 mobile face or coal drills, and 29 rock drills. Cutting machines totaled 87. Haulage equipment included 65 locomotives, 60 rubber-tired tractors, 931 mine cars, 50 shuttle cars, and 51 conveyors. Mainline track totaled 15.7 miles and all other track 12.3 miles. Strip mine equipment included 15 diesel shovels and 1 diesel-electric power shovel, 17 bulldozers, and 24 trucks or tractor-trailers. Auger equipment included 2 augers and 2 bulldozers. Principal coal producers were Clinchfield Coal Co., Wisco Coal Co., Inc., Mountain Mining Co., Inc., and Contracting Enterprises, Inc. Production came primarily from the Upper and Lower Banner, Clintwood, and Splashdam coal seams.

Clinchfield Coal Co. produced and delivered natural gas to the Kentucky-West Virginia Gas Co. for use in the surrounding area. There was no new drilling in the county.

Honaker Sand Co. dredged bank-run building sand at a new operation at Haysi.

Dinwiddie.—Southern Materials Co., Inc., quarried and crushed granite at its Jack quarry near Petersburg for roadstone and riprap. The riprap was supplied to the Chesapeake Bay Bridge-Tunnel project. Shale was mined under contract by Daniels Brick and Tile Co., Inc., for the manufacture of vitrified sewer pipe and flue lining at the company plant near Richmond. A small quantity of gravel was mined and processed for road construction.

Fairfax.—The county rose to first place among counties producing sand and gravel. Output increased 22 percent and constituted 26 percent of the State total. The major quantity was processed for building and road construction. Portable operations were by George F. Dodd Corp. and Mt. Vernon Sand & Gravel Co., Sidney R. Johnston, and Potomac Sand and Gravel Co. Other large producers included Alexandria Sand & Gravel Co., Hill Top Sand & Gravel Co., Inc., Modern Sand & Gravel Corp., and Virginia Sand & Gravel Co., Inc.

Granite was quarried and crushed for riprap, concrete aggregate, roadstone, and railroad ballast by W. E. Graham & Sons Division, Vulcan Materials Co., at a quarry near Occoquan. Fairfax Quarries Inc., near Centreville, produced diabase (traprock) for concrete aggregate and roadstone. Oystershell was crushed by Herbert Bryant, Inc., Alexandria, for poultry grit and agricultural purposes.

Fauquier.—Basalt (traprock) was quarried and crushed for concrete aggregate and roadstone by Sanders Quarry Inc., near Warrenton and Chadbourn Gotham, Inc. (formerly Riverton Lime & Stone Co. Division of Chadbourn Gotham, Inc.) near Paris. Millbrook Quarries, Inc., sold its Broad Run limestone quarry to N. C. Miller Interests of Alexandria. The quarry was idle the entire year. Irregularly shaped sandstone rubble and flagging were produced and sold by J. W. Costello and Lofton Lambert, The Plains, and W. A. Lansdowne and Will Miller, Haymarket. The James Edward Corum Broad Run sandstone quarry was idle.

Franklin.—Blue Ridge Talc Co., Inc., continued to mine and grind soapstone at its King-Ramsey mine near Henry, production decreased. Insecticides and foundry facing were the chief markets for this material. Various finished iron oxide pigments also were produced by this firm at Henry.

Frederick.—Output of limestone in Frederick County rose to nearly 1.5 million tons, and the county was fourth in quantity and second in value among limestone-producing counties. W. S. Frey Co., Inc., produced limestone for concrete aggregate, roadstone, and fluxing stone from its quarry at Clearbrook. M. J. Grove Lime Co., Division of The Flintkote Co., operated limestone quarries at Middletown and Stephens City for metallurgical flux, concrete aggregate, roadstone, agstone, and cement, lime, and glass manufacture. Sizable quantities of stone sand also were shipped. Stuart M. Perry, Inc., quarried and crushed limestone near Winchester for concrete aggregate, roadstone, agstone, stone sand, and filler in soap. A new operation was the production of limestone for concrete aggregate and roadstone by Salem Stone Corp., Salem, from a quarry near Stephens City. Terra Alta Limestone Co. did not operate its limestone quarry at Aurora during the year.

M. J. Grove Lime Co., Division of The Flintkote Co., produced hydrated and quicklime at its Stephens City plant. Lime-burning

equipment included seven shaft kilns, and one batch and one continuous hydrator. Natural gas was the fuel. Virginia Glass Sand Corp. produced glass sand at a stationary plant near Gore. A small tonnage was also sold for building purposes. Shenandoah Brick & Tile Corp. mined shale near Winchester for manufacturing building brick.

Giles.—National Gypsum Co. and Standard Lime & Cement Co., Division of Martin-Marietta Corp. produced lime chiefly for chemical and industrial uses near Kimballton. Agricultural lime and mason's lime were also produced. Calcining equipment consisted of five coal-fired rotary kilns. Ripplemead Lime Co., Inc., produced mason's, agricultural, and chemical lime in a coal-fired, shaft-kiln plant at Ripplemead.

National Gypsum Co. and Standard Lime & Cement Co., Division of Martin-Marietta Corp., both near Kimballton, and Virginian Limestone Corp., and Ripplemead Lime Co., Inc., near Ripplemead, quarried and processed limestone for lime manufacture, concrete aggregate, roadstone, and coal-mine dusting. Total production in Giles County was only slightly less than in 1961. Iron ore exploration by Minerals Development Co. continued.

Goochland.—Granite for roadstone was produced by Boscobel Granite Corp. at its Manakin quarry. W. E. Graham & Sons, Division of Vulcan Materials Co., quarried granite for use as concrete aggregate and roadstone from the Royal Stone quarry near Hylas (formerly Royal Stone Corp.).

Grayson.—Grayson Stone Corp., a new firm reporting for the first time, quarried and crushed limestone for concrete aggregate and roadstone at a quarry near Fries.

Greensville.—Trego Stone Corp. quarried and crushed granite for concrete aggregate roadstone, and riprap near Skippers. Production was about the same as in 1961.

Halifax.—W. E. Graham & Sons, Division of Vulcan Materials Co., produced granite for riprap, concrete aggregate, and roadstone at a quarry near South Boston.

Hanover.—The Verdon granite quarry near Doswell, operated by General Crushed Stone Co., produced stone for concrete aggregate, roadstone, railroad ballast, and riprap.

M. & T. Chemicals Inc., (formerly Metal & Thermit Corp.) produced ilmenite, rutile, and aplite at its Beaver Dam plant near Montpelier.

Virginia Gems & Minerals Co. collected moonstones and other mineral specimens from various localities.

Henrico.—The county declined to second place among the counties mining sand and gravel. The major quantity was washed and screened for building and road construction. Smaller quantities were used for fill and septic tank installation. Southern Materials Co., Inc., operated its No. 12 dredge on the James River. Stationary plants were operated by Carter Sand & Gravel Co., Inc., Commonwealth Sand & Gravel Corp., West Sand & Gravel Co., Inc., and two small producers.

Tidewater Crushed Stone Co. in Richmond produced crushed granite for use as concrete aggregate, roadstone, railroad ballast, and riprap.

Henry.—Crushed granite for highway construction and road maintenance was produced by A. C. Wilson Construction Co. at its Horse

Pasture quarry, by Snyder Stone Quarry, and by Martinsville Stone Corp., all near Martinsville. The latter firm has operated its quarry since 1958 on a granite mass of undetermined thickness. Nine of the 20 employed men worked in the pit and the others in the crushing and sizing plant and in the shop. The overburden consisted of a 35-foot thickness of shale and clay. The upper 100 to 150 feet of the dome-shaped mass was being mined at the end of 1962. Stone was transported from the pit by diesel-powered trucks, and the drilling was dry with air-powered track-mounted wagon drills.

Isle of Wight.—Battery Park Fish & Oyster Co. produced lime using as raw material oystershell obtained as a byproduct of oyster canneries. The quicklime was hydrated and sold for agricultural purposes. Bank-run sand was produced by Zuni Sand Co., Inc., at a stationary wet plant near Zuni.

King William.—Sand and gravel for building and road construction was mined and processed at a stationary plant near Aylett by Fox Company.

Lee.—Production of bituminous coal was about the same as in 1961. The number of mines increased from 70 to 87. Of these, 83 were underground mines, 2 were strip mines, and 2 were auger mines. About 93 percent of the production was from underground operations. Underground drilling equipment included 64 handheld and post-mounted face or coal drills. Underground haulage was by means of 35 locomotives, 10 rubber-tired tractors, 255 mine cars, and 3 shuttle buggies. Cutting machines totaled 43. Mine trackage totaled 12.6 miles of mainline and 1 mile of other track. Strip mining equipment included 2 diesel-powered shovels, 2 bulldozers, 1 horizontal power drill, and 5 trucks or tractor-trailers. Equipment at auger mines included 2 augers, 2 bulldozers, and 5 trucks or tractor-trailers. The chief producers included Darby Fuels, Inc., Wright Coal Co., Betsy Darby Coal Co., Laurel Branch Coal Co., and Moses Coal, Inc. Coal was mined mainly from the No. 5, Darby No. 5, and Marker Seams.

Limestone was quarried for concrete aggregate, roadstone, agstone, coal-mine dust, filtration, and for stone sand by Kentucky-Virginia Stone Co., Inc., at its Wheeler quarry near Gibson Station. Woodway Stone Co., Woodway, quarried and crushed limestone for concrete aggregate and roadstone.

Petroleum production in Virginia was confined to the Rose Hill oil field in Lee County. No new drilling activity was reported. Shell Oil Co. undertook an extensive exploratory program in this county. Seismograph reflections obtained from the subsurface rock may provide a basis for future drilling programs.

Loudoun.—The county remained the leading basalt producing area and ranked second in the State in total tonnage of all stone produced and first in total value. Output reached 1.8 million tons, a 13 percent rise over 1961 production. Firms producing crushed basalt were Chantilly Crushed Stone, Inc., Arcola, and Virginia Trap Rock, Inc., and Arlington Stone Co., both near Leesburg. Basalt also was produced by Bull Run Stone Co. near Manassas for highway construction and maintenance. A small producer mined and prepared sand for road paving and use on ice.

Louisa.—Crushed limestone was produced at Gordonsville for highway construction and maintenance by Superior Stone Co., Division of Martin-Marietta Corp.

Mecklenberg.—Production of crushed granite at the Buggs Island quarry of W. E. Graham & Sons, Division of Vulcan Materials Co., increased substantially compared with that of 1961. Riprap, concrete aggregate, and roadstone were the chief uses.

Montgomery.—Crushed limestone for concrete aggregate, roadstone, and agstone was produced by Montgomery Limestone Corp. at its Ellett quarry near Christiansburg. This firm also produced limestone for highway construction and maintenance at its Shawsville quarry near Christiansburg. Concrete aggregate and roadstone were prepared at its Ironto Sandstone quarry by this company's Ironto Sand Co. Division (formerly Velvet Sand Co.).

Two coal producers mined a small tonnage of semi-anthracite from the Brushy Mountain coal seam. Jones & Keister Coal Co. was the larger of the two firms.

Building brick was manufactured by Old Virginia Brick Co., Inc., from shale mined near Elliston.

Nansemond.—Calcareous marl was mined at Chuckatuck. Clay was dredged from the Nansemond River near Suffolk by Lone Star Cement Corp. for captive use in the manufacture of cement at South Norfolk, Norfolk County.

Webster Brick Co., Inc., manufactured building brick from miscellaneous clay mined near Suffolk.

Nelson.—Ground and dimension soapstone was produced by Alberene Stone Division of Georgia Marble Co. near Schuyler. Dimension stone included flagging and laboratory and architectural stone. Flagging was irregularly-shaped slabs averaging 1¼ inches in thickness, and laboratory and architectural stone was prepared by sawing and splitting at the Schuyler mill. Roofing, rubber, and other filler uses were the chief markets for the ground material. Production was less than in 1961, and the crushing plant closed on September 15 because of lack of orders.

Buffalo Mines, Inc., and Consolidated Feldspar Department of International Minerals & Chemical Corp. mined aplite near Piney River. These two firms and Riverton Lime & Stone Co., Dominion Minerals Division, operated crushing and grinding plants, the bulk of the output being sold for glass manufacture. Crude rock from Amherst County was processed by Riverton Lime & Stone Co. Much of the shipments of aplite by Riverton Lime & Stone Co., Dominion Minerals Division and Buffalo Mines, Inc., was sold as concrete aggregate, roadstone, roofing granules, and as a 200-mesh product to the brick and block industry. Glass plants in New Jersey, Ohio, West Virginia, Virginia, and Maryland, used most of the aplite consumed in glass manufacture. Shortly before the end of 1962, the production of aplite for glass manufacture by Riverton Lime & Stone Co. was discontinued and the processing plant was closed. Production of aplite for concrete aggregate and roadstone, however, was being continued.

The Buffalo Mines, Inc., operation near Piney River was an open-pit mine served by truck and the Virginia Blue Ridge Railway. Four

men were employed in the pit, 5 days a week. The mine was developed in a lens of aplite.

Rutile and other minerals were collected as mineral specimens near Roseland by John O. Greisbach.

Norfolk.—Lone Star Cement Corp. manufactured portland cement in South Norfolk using calcareous marl and clay from its pits in Nansemond County. Using the wet process, this company burned cement at three 7.7- by 219-foot kilns and one 10.5- by 340-foot kiln. General use and moderate heat cement (Types I–II) was produced. Electrical energy was purchased.

Reliance Fertilizer and Lime Corp. produced lime at Norfolk from shell purchased from J. H. Miles & Co., Inc., also of Norfolk. Hydrated lime was sold for agricultural purposes. The mixed feed for the company's four pot kilns consisted of 50 percent shell and 50 percent dolomitic limestone, which was purchased also.

Interstate Division, Commonwealth Sand & Gravel Corp., processed sand dredged near Norfolk for railroad ballast. Small quantities also were used for paving and building.

Both domestic gypsum and gypsum from Nova Scotia were calcined by United States Gypsum Co. at its Norfolk plant for use in plaster and other products. Crushed gypsum also was sold for agricultural purposes. Three fertilizer plants in or near Norfolk, the Baugh Chemical Co., Chas. W. Priddy & Co., Inc., and F. S. Royster Guano Co., imported crude gypsum from Nova Scotia for use as land plaster. The consumers for this product were peanut farmers.

Virginia Smelting Co., West Norfolk, produced zinc sulfate for use as a pigment.

Northampton.—Paving sand used in constructing the new Chesapeake Bay Bridge-Tunnel continued to be produced by Southern Materials Co., Inc., at its portable Eastern Shore sand plant.

Nottoway.—Granite was quarried, crushed, and sized for highway road construction and concrete aggregate by Burkeville Stone Corp., Inc.

Orange.—Webster Brick Co. mined shale and mudstone near Orange for manufacturing building brick. The output increased moderately compared with 1961.

Patrick.—The A. C. Wilson Construction Co. limestone quarry near Patrick Springs was permanently abandoned.

Pittsylvania.—Granite was quarried near Danville by Superior Stone Co., Division of Martin-Marietta Corp., for concrete aggregate and roadstone. Five men were employed in the pit on a 5-day-per-week basis. A bench system of mining was used, with 2 benches, 35 feet and 54 feet in height, respectively. Overburden totaled 10 feet. Stone was transported from the pit to the crusher in 15-ton-capacity diesel-powered trucks. Drilling was dry with an air-powered, track-mounted wagon drill.

River sand was dredged from the Sandy River by a dragline, dried, screened, and sold for paving at a portable plant near Danville by Kendall Sand Works. Sand for building and fill was produced at a stationary plant in the same area by Marshall Sand & Gravel Co.

Prince Edward.—Kyanite was produced by Kyanite Mining Corp. on Baker Mountain and processed at its Cullen flotation plant. The re-

fined product was used in high temperature refractories and special ceramic bodies. The company also reported production of building, beach, and traction sand at its Baker Mountain property for the first time.

Prince George.—Although sand and gravel production decreased slightly, Prince George County dropped to fifth place among counties in the State. Building and paving sand and gravel was produced and processed by Friend Sand & Gravel Co., Inc., Whitehill plant, and by Southern Materials Co., Inc., Puddledock plant. Bank-run sand and gravel was produced by Hitch Gravel Corp. at its Powell's Creek plant. The sand was used for fill and the gravel for paving.

Allied Chemical Corp., Nitrogen Division, Hopewell, produced nitrogen compounds for use in fertilizer and manufactured ammonia, ammonium sulfate, urea solution, solid and solution ammonium nitrate, ammonium nitrate-limestone, and other compounds.

Perlite obtained from Colorado was expanded at Hopewell by Virginia Perlite Corp. for building plaster, concrete aggregate, and soil conditioning.

Prince William.—Miscellaneous clay was mined by Woodbridge Clay Products Co. near Manassas and prepared for the manufacture of building brick. Production increased sharply during the year because of the installation of a second continuous-type kiln and dryer which doubled the plant capacity to 150,000 brick per day.[19]

Virginia Concrete Co., formerly Gainesville Stone Quarry, Inc., quarried and crushed diabase (traprock) for concrete aggregate and roadstone.

Princess Anne.—Sand production increased for the second consecutive year. Output rose 57 percent, and the county ranked fourth among counties mining sand and gravel. Most of the sand was used for fill, building, and paving. Small quantities of fertilizer filler, engine, molding, filtration, and foundry sand were also mined. Seventy-five percent of the total sand was processed. In addition to its Mears Corner plant, E. C. Womack, Inc., operated its new Diamond Springs dragline near Norfolk. Other leading producers were R. H. Baillio Co., Tidewater Sand Co., Inc., and E. V. Williams Co., Inc. There was no gravel production in the county.

Pulaski.—Limestone quarried by Radford Limestone Co., Inc., Radford, was processed at a stationary plant in Montgomery County. Concrete aggregate, roadstone, railroad ballast, and agstone comprised the principal uses, although a sizable tonnage was sold as stone sand for use in concrete and masonry. Limestone for concrete aggregate and roadstone also was produced by Salem Stone Corp. at its Newburn quarry near Dublin. The New River quarry of Montgomery Limestone Corp. was idle.

Brown and yellow crude iron oxide pigments were produced by American Pigment Corp. near Hiwassee. Ochre, sienna, umber, and other finished pigments were shipped from the nearby processing plant. Another plant operated at Pulaski by the same firm produced and shipped manufactured black, brown, red, and yellow iron oxide pigments.

Roanoke.—Rockydale Quarries Corp. produced limestone for highway maintenance, construction, and agstone at its quarry at Rocky-

[19] Pittsburgh Press. Expansion of Brick Plant Completed. July 12, 1962, p. 49.

dale near Roanoke. Salem Stone Co., Inc., opened a new quarry and mined crushed limestone for concrete aggregate and roadstone. Blue Ridge Stone Corp. also operated a limestone quarry near Roanoke from which crushed material was shipped for concrete aggregate and roadstone.

Old Virginia Brick Co., Inc., produced shale near Salem for making building brick. Production increased substantially as a result of increased plant capacity.

Rockbridge.—C. W. Barger and Son Limestone Quarry, Inc., formerly known as Charles W. Barger and Son, quarried and crushed limestone for concrete aggregate and roadstone. Lone Jack Limestone Co., Inc., operated adjacent limestone and quartzite quarries near Glasgow for concrete aggregate, roadstone, and railroad ballast. All the stone was crushed at one plant. W. G. Mathews, Jr., Inc., Natural Bridge Station (Greenlee), quarried and crushed quartzite for use in manufacturing ferrosilicon. The plant was closed June 30.

Locher Silica Corp., Glasgow, mined and prepared sand for glass and other industrial uses at its Goshen plant. Miscellaneous surface clay was mined under contract near Glasgow for making building brick by Locher Brick Co., Inc. Mineral collectors collected unakite and other mineral specimens near Vesuvius.

Rockingham.—Zinc ore mined at its Bowers-Campbell mine was concentrated by Tri-State Zinc, Inc., near Timberville. Zinc flotation concentrate was shipped to the St. Joseph Lead Co. smelter at Josephtown, Pa.

Limestone was mined and crushed near Harrisonburg by Fred K. Betts, III, and R. Y. Frazier for use as concrete aggregate, roadstone, and for agstone. C. S. Mundy Quarries, Inc., mined and processed limestone at a quarry near Broadway for use as concrete aggregate, roadstone, for agstone, and for lime and cement manufacture. All three firms operated stationary plants. Two of them produced high calcium limestone and the other dolomitic limestone. Crushed marble for terrazzo was produced near Harrisonburg by Jamison Black Marble Co., Division of General Stone and Materials Corp., formerly Jamison Black Marble Co., Inc. Grottoes Sand & Gravel Co., Inc., produced washed and screened building sand and paving gravel at a stationary plant near Grottoes.

Russell.—Production of coal in Russell County increased 5 percent over that of 1961. Forty-eight mines were active, of which 39 were underground mines, 6 were strip mines, and 3 were auger mines. Ninety-two percent of the coal produced in the county was from underground mines. Equipment consisted of 45 handheld and postmounted face or coal drills, 14 rock drills, 46 locomotives, 19 rubber-tired tractors, 799 mine cars, 2 conveyors, and 35 cutting machines. Mainline track totaled 6.6 miles and other track, 10.3 miles. Strip mine equipment included 5 diesel-powered shovels, 1 diesel-operated dragline, 4 bulldozers, 2 horizontal power drills, and 14 trucks or tractor-trailers. Equipment at auger mines included 4 augers, 2 bulldozers, and 2 trucks or tractor-trailers. The principal producers were Clinchfield Coal Co., Wisco Coal Corp., Smith Coal Co., and Hicks Coal Co. The Tiller, Upper and Lower Banner, and Red Ash seams were the principal seams mined.

Clinch River Quarries produced crushed limestone for road construction and maintenance near St. Paul. Shale obtained as a co-

product from the preparation plant of the Moss No. 2 Mine of the Clinchfield Coal Corp. was utilized in the manufacture of lightweight aggregate by that firm's Lightweight Aggregate Division near South Clinchfield.

Scott.—Foote Mineral Co. quarried limestone from an underground mine near Duffield for making lithium hydroxide at its spodumene processing plant at Sunbright. Limestone was produced by Penn-Dixie Cement Corp. at its Speers Ferry quarry for use at its Kingsport, Tenn., cement plant. Limestone for concrete aggregate, road construction, and railroad ballast was produced at Glenita near Clinchport by Natural Tunnel Stone Co. Tri-State Lime Co., formerly Blountville Construction Co., also quarried limestone for road construction, highway maintenance, agstone, fertilizer filler, and filtration use.

Shenandoah.—Dominion Division of Chemstone Corp. quarried limestone for the manufacture of quicklime and hydrated lime near Strasburg. The lime, produced in four gas-fired shaft kilns and continuous hydrators, was sold chiefly as a flux in steel manufacture. Sizable quantities were also used in paper and pulp manufacture, sewage and trade-wastes treatment, and water purification and softening. Lime was shipped to a number of eastern and southern States, although Pennsylvania and Ohio consumed the major portion.

A new quarry, the Fee quarry, was operated by Chemstone Corp., in addition to the Lease quarry operated by the company's Dominion Division. The Fee quarry produced limestone primarily for flux in open-hearth steel mills, but small quantities were also sold for road construction and maintenance and for cement manufacture. In addition to use for flux and lime manufacture, a small quantity of limestone from the Lease quarry was sold for road construction and maintenance, and for asphalt filler. Toms Brook Lime & Stone Co., Inc., Toms Brook, C. S. Mundy Quarries, Inc., Forestville, and Kipps Magnesium Limestone Quarry, operated by Nenetah K. Kipps at Mt. Jackson, produced crushed limestone for concrete aggregate, road construction, and for agstone. Shenandoah Valley Lime & Stone Corp., Strasburg, produced high-calcium limestone for flux in blast furnaces and open-hearth plants.

Smyth.—Chemicals Division of Olin-Mathieson Chemicals Corp. quarried limestone at its Worthy mine primarily for making lime at the company operation near Saltville. Stone was conveyed from the mine to the plant by aerial tramway. The lime plant consisted of 3 rotary and 14 vertical coal- and coke-fired kilns. Quicklime combined with salt brine pumped from its own salt wells was used to manufacture chlorine, soda ash, and other chemicals.

Holston River Quarry, Inc., with a stationary plant near Marion and the Cardinal Construction Co. with a portable plant at its Sanders quarry near Chilhowie produced crushed limestone for concrete aggregate and roadstone. E. P. Ellis Quarry, formerly producing limestone near Marion, no longer produced it. The underground Locust Cove Gypsum Mine under development by the United States Gypsum Co. did not reach the production stage in 1962. The mine is located about 18 miles from Saltville.

Building sand was mined and processed at stationary plants by Sayers Sand Co. and C. R. Snider & Sons Sand Co., both near Marion, and by Sugar Grove Sand & Lime Co. at Sugar Grove. Paving grav-

el was produced and prepared by Sayers Sand Co. and by one other producer. Shale was mined near Marion by Appalachian Shale Products Co. for making building brick. Production was 3 percent greater than in 1961. General Shale Products Corp. was to acquire this firm January 1, 1963, and operate it as the Appalachian Shale Division of the company.

Spotsylvania.—Massaponax Sand & Gravel Corp. mined sand and gravel for building and road construction at its stationary operation near Fredericksburg. Concrete aggregate, roadstone, and a small quantity of riprap were produced at a granite quarry near Fredericksburg by Fredericksburg Stone Co.

Stafford.—S. J. Groves & Sons Co. operated a new gravel pit where bank-run paving gravel was produced. Fredericksburg Sand & Gravel Co., Inc., mined and processed sand and gravel for building and road construction at its stationary plant near Fredericksburg. Jobe Newton mined and sold unprocessed sand for building and fill near Fredericksburg.

Sussex.—Adams Construction Co. operated a new stationary plant near Stony Creek and produced and processed paving sand and gravel.

Tazewell.—The county ranked fifth among coal-producing counties. Output was less than in 1961. Of the 29 active mines in the county, 23 were underground mines, 2 were strip mines, and 4 were auger mines. Nearly 60 percent of the production was from underground mines and 30 percent from auger mines. Underground equipment included 29 handheld and postmounted face and coal drills, 13 locomotives, 12 rubber-tired tractors, 159 mine cars, and 25 cutting machines. Mainline track totaled 5.5 miles and other track 2 miles. Three diesel-powered shovels, 2 bulldozers, and 5 trucks or tractor-trailers were used in strip mining, and 4 augers, 1 diesel-powered shovel, 5 bulldozers, 1 power drill, and 11 trucks or tractor-trailers were used in the auger mines. The principal coal producers were Southeastern Mining Co., Alfredton Coal Co., and Rebecca Coal Co. The coal was obtained chiefly from the Upper Seaboard, Jawbone, and Red Ash seams.

Pounding Mill Quarry Co. operated its two quarries at Bluefield and Pounding Mill, producing crushed limestone mainly for road construction and maintenance. Other uses included blast furnace flux, agstone, railroad ballast, dust for coal mines, and stone sand.

Peery Lime Co., Inc., North Tazewell, and Blue Grass Lime Co., Maxwell, quarried limestone for use in their own lime kilns. The hydrated lime produced was used as mason's lime and agriculture lime. Most of this lime was consumed in Virginia and Tennessee, but some shipments went to North Carolina and West Virginia.

Shale was mined at an open pit near Richlands by General Shale Products Corp. for making building brick.

Warren.—Riverton Lime & Stone Co., Division of Chadbourn Gotham, Inc., quarried a shaley limestone to manufacture masonry cement. Production was substantially higher than in 1961, and the finished product was shipped principally in Virginia and to North Carolina and the District of Columbia. Riverton Lime & Stone Co. also produced limestone from a quarry near the Shenandoah River. The product was prepared for concrete aggregate, roadstone, and agstone. Skyline Crushed Stone Co. near Front Royal was idle

during the year. A small quantity of sand was also produced and prepared for road construction.

Washington.—Crushed limestone used chiefly for concrete aggregate, roadstone, and agstone was produced by Lambert Bros., Inc., Division of Vulcan Materials Co. at Bristol and Glade Springs; Acme Stone Co., Inc., Division of Lambert Bros., at Abingdon; and Washington County Stone Co. and Meadowview Lime Co., both near Meadowview.

The United States Gypsum Co. operated its gypsum mine and mill at Plasterco. Plasterboard and other gypsum products were manufactured for sale to the construction and other industries.

A small quantity of sand was mined and processed for paving by two producers.

Westmoreland.—Sand for building, and sand and gravel for paving and other uses, was produced by Potomac Sand & Gravel Co. at a stationary plant near Kinsale.

Wise.—The county ranked as the third largest bituminous-coal-producing county, accounting for 21 percent of the coal produced in Virginia. The county also ranked first in output of strip-mined coal. The number of active mines rose to 291 from 236 in 1961. Among the operating mines in 1962, 261 were underground mines, 20 were strip mines, and 10 were auger mines. Nearly four-fifths of the county tonnage was from underground mines. Equipment used in underground mines included 288 handheld and postmounted face or coal drills, 34 rock drills, 119 locomotives, 70 rubber-tired tractors, and 1,197 mine cars. Also used in underground mines were 50 shuttle cars, 7 shuttle buggies, 42 conveyors, and 190 cutting machines. Mainline track totaled 25.4 miles and other track, 4.6 miles. Strip mine equipment included 4 diesel-electric and 34 diesel-powered shovels, 1 gasoline-powered shovel, 34 bulldozers, 7 horizontal and 5 vertical power drills, and 27 trucks or tractor-trailers. Auger mine equipment included 11 augers, 10 bulldozers, and 1 power drill. The chief coal producers included Stonega Coke and Coal Co., Stamach Mining Co., Coal Processing Corp., Stallard-Womack Coal Corp., Wise Coal and Coke Co., and Sunrise Coal Co., Inc. Coal was obtained from a number of seams including Kelly, Imboden, Upper Banner, Clintwood, Blair, Norton, and Taggart.

An account of the reconstruction of the raw coal storage and conveying facilities of the Coal Processing Corp. plant near Norton was published. These facilities had been destroyed by fire late in December 1961. In the article were detailed descriptions of the coal washing apparatus and the mining methods, including continuous mining machines and more conventional mining practices. The plant resumed its annual daily shipments of 2,000 tons of metallurgical coal by March 1.[20]

Beehive coke was produced in Wise County by five firms—Christie Coal & Coke Co., Hawthorne Coke & Mining Co., Stonega Coke & Coal Co., Norton Coal Co., and Wise Coal & Coke Co. The plants were located at or near Esserville, Hawthorne, Pine Branch, Norton, and Dorchester, respectively. The number of operating ovens

[20] Coal Age. Cooperating for Fast Plant Rebuilding at Coal Processing. V. 67, No. 9, September 1962, pp. 73–74, 77.

totaled 667, of which 546 were machine-drawn ovens and the balance (121) were hand-drawn ovens. No byproducts were recovered.

Limestone for concrete aggregate and roadstone was quarried and crushed near Big Stone Gap by Southwest Quarries, Inc. C. E. Roberson produced and processed sand for masonry use at a stationary plant near Pound.

Wythe.—Lead and zinc were produced by The New Jersey Zinc Co., Bertha Minerals Division, at its Austinville mill which operated the entire year. Tonnage of zinc recovered was greater than in 1961. The mill treated ores from both the Ivanhoe and the Austinville mines. Ore from the Ivanhoe mine was conveyed to the mill at Austinville by an underground tunnel. Zinc concentrate was treated by The New Jersey Zinc Co. at Palmerton, Pa., E. I. du Pont de Nemours & Co., Inc., Grasselli Chemicals Dept. at East Chicago, Ind., and by St. Joseph Lead Co., Josephtown, Pa. Lead concentrate was shipped chiefly to The New Jersey Zinc Co. smelter at Palmerton, Pa., and to Japan. No byproduct silver was recovered in 1962.

Crushed limestone was produced for concrete aggregate and roadstone by Pendleton Construction Corp., Wytheville, and H. D. Crowder & Sons, near Austinville. Finely divided limestone recovered as a byproduct from lead and zinc concentration at The New Jersey Zinc operations at Austinville was sold chiefly as agstone, although a small quantity was sold for fertilizer filler. Newman Bros., Hillsville, produced crushed sandstone at a quarry near Patterson for road construction and maintenance. Silica Products Co. mined and processed building sand at a stationary plant near Wytheville.

York.—Building and paving sand was mined and prepared by the Southern Materials Co., Inc., at a portable plant near Seaford.

The Mineral Industry of Washington

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Washington Division of Mines and Geology for collecting information on all minerals except fuels.

By Frank B. Fulkerson,[1] Jerry J. Gray,[2] and William N. Hale [2]

ANNUAL mineral-production value in Washington continued its slow but steady increase in 1962. The value totaled $68.5 million, which was 3 percent more than in 1961. Greater output of sand and gravel and stone, which supplied 53 percent of the total value, accounted for most of the increase. Production of cement, another major nonmetal commodity, declined slightly. In metal

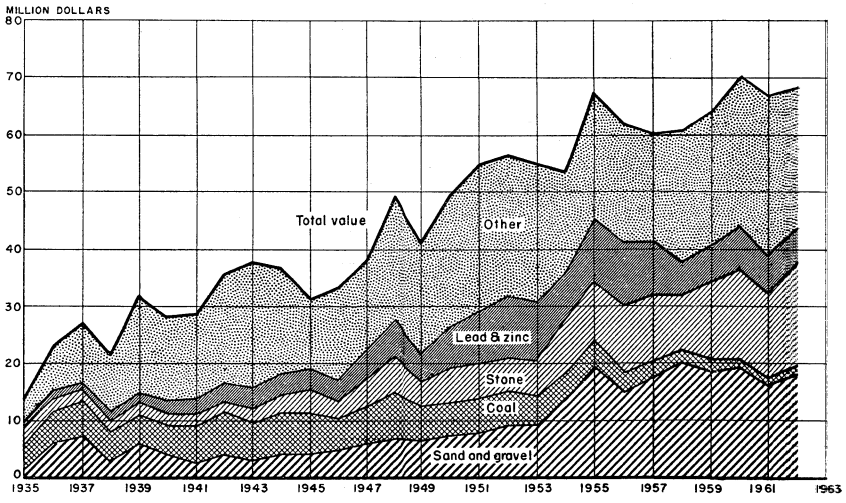

FIGURE 1.—Value of sand and gravel, coal, stone, lead and zinc, and total value of mineral production in Washington, 1935–62.

mining, zinc production advanced, but output of gold, lead, and uranium ore declined. Coal was the principal mineral fuel produced in Washington; output, which had been decreasing, increased over that of 1961.

From 1952 through 1962, the value of the State's mineral production rose an average of 2 percent each year, primarily because of greater tonnages of sand and gravel and stone. Unit values and prices

[1] Economist, Bureau of Mines, Albany, Oreg.
[2] Geologist, Bureau of Mines, Albany, Oreg.

TABLE 1.—Mineral production in Washington [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite—short tons	5,100	$42	(2)	(2)
Clays [3]—thousand short tons	145	138	103	$100
Coal (bituminous)—do	191	1,381	235	1,630
Copper (recoverable content of ores, etc.)—short tons	66	40	41	25
Lead (recoverable content of ores, etc.)—do	8,053	1,659	6,033	1,110
Peat—do	57,393	363	42,762	288
Pumice—thousand short tons	(2)	(2)	10	130
Sand and gravel—do	18,994	16,145	19,580	18,145
Stone—do	11,464	14,758	12,749	18,180
Talc and soapstone—short tons	2,927	23	2,835	11
Uranium ore—do	175,327	3,582	110,948	2,050
Zinc (recoverable content of ores, etc.)—do	20,217	4,650	21,644	4,978
Value of items that cannot be disclosed: Abrasive stone (grinding pebbles), carbon dioxide, cement, diatomite epsomite, gem stones, gold, gypsum (1961), lime, magnesite, olivine, silver, tungsten (1961), and values indicated by footnote [2]		23,667		21,827
Total		[4] 66,448		68,474

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Excludes fire clay and bentonite; included with "Value of items that cannot be disclosed."
[4] Revised figure.

TABLE 2.—Indicators of Washington business activity

	1961	1962 [1]	Change (percent)
Personal income:			
Total—million dollars	6,911.0	7,422.0	+7.4
Per capita—dollars	2,381.0	2,469.0	+3.7
Construction activity:			
Building permits—million dollars	370.5	439.7	+18.7
Heavy engineering awards—do	175.5	225.4	+28.4
State highway commission:			
Value of contracts awarded—do	66.9	71.1	+6.3
Value of contract work performed—do	50.4	59.8	+18.7
Cement shipments to and within Washington—thousand 376-pound barrels	5,506.4	4,982.9	−9.5
Cash receipts from farm marketing—million dollars	548.9	575.8	+4.9
Factory payrolls—do	1,355.0	1,509.8	+11.4
Annual average labor force and employment:			
Total labor force—thousands	1,098.7	1,124.4	+2.3
Unemployment—do	74.2	60.4	−18.6
Employment:			
Construction—do	45.6	44.9	−1.5
Aircraft—do	62.3	73.2	+17.5
Lumber and wood products—do	41.6	42.8	+2.9
Food processing—do	26.8	26.9	+0.4
All manufacturing—do	217.5	232.3	+6.8
All industries—do	1,024.1	1,063.6	+3.9

[1] Preliminary figures.

Sources: Survey of Current Business, Construction Review, Pacific Builder and Engineer, Washington State Highway Commission, The Farm Income Situation, Washington Employment Security Department, and Bureau of Mines.

averaged about the same in 1962 as in 1952, with higher unit values for some commodities offset by declining prices for others.

The value of primary aluminum production ($178.2 million) was 6 percent greater than the 1961 value, and the tonnage (372,000 tons) was 12 percent greater. Employment averaged 6,000, compared with 5,700 in 1961. Potlines at Wenatchee and Mead were reactivated, because of the uptrend of market demand for the metal. Alumina

TABLE 3.—Annual employment and total wages in the mineral industries

Industry	1961		1962	
	Employment	Wages (thousands)	Employment	Wages (thousands)
Mining:				
Metal mining	616	$4,045	594	$3,730
Bituminous coal, crude petroleum, and natural gas	251	1,558	282	1,836
Nonmetallic mining and quarrying	962	6,108	1,015	6,695
Total	1,829	11,711	1,891	12,261
Stone, clay, and glass products:				
Cement, hydraulic	549	3,535	503	3,379
Structural clay products	294	1,626	285	1,696
Concrete, gypsum, and plaster products	3,306	20,474	3,590	22,881
Other	746	4,516	799	5,114
Total	4,895	30,151	5,177	33,070
Smelting, refining, and casting:				
Blast furnaces, steel works, rolling and finishing mills	1,836	12,133	1,477	10,133
Iron and steel foundries	905	5,337	933	5,670
Smelting, refining, and casting of nonferrous metals, except aluminum	956	5,589	1 009	6,208
Smelting, rolling, drawing, and casting of aluminum	5,660	40,623	6,028	44,004
Miscellaneous	49	318	54	367
Total	9,406	64,000	9,501	66,382
Industrial chemicals [1]	9,002	75,983	8,953	74,254
Petroleum refining and related industries	1,352	9,572	1,251	9,243
Grand total	26,484	191,417	26,773	195,210

[1] The Hanford atomic plant is the largest in this classification.

Source: Washington Employment Security Department bulletins on industries covered by Washington State Employment Security Act. Industry groups may differ from those in the Bureau of Mines canvass.

TABLE 4.—Employment and injuries in the mineral industries

Year and industry	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1961:						
Quarries and mills [1 2]	958	218	1,670,138	----------	21	13
Nonmetal mines and mills	197	166	262,104	----------	3	11
Sand and gravel operations [2]	842	196	1,321,754	----------	23	17
Metal mines and mills	454	262	953,243	1	51	55
Coal mines	195	172	268,262	----------	25	93
Total	2,646	211	4,475,501	1	123	28
1962: [3]						
Quarries and mills [1 2]	902	198	1,427,416	----------	13	9
Nonmetal mines and mills	196	105	164,062	1	5	37
Sand and gravel operations [2]	908	176	1,275,414	1	26	21
Metal mines and mills	497	240	955,408	1	42	45
Coal mines	205	213	349,041	----------	64	183
Total	2,708	193	4,171,341	3	150	37

[1] Includes cements- and lime-processing plants.
[2] Includes only commercial operations.
[3] Preliminary figures.

plants in the Southwest and South supplied the basic raw material for aluminum reduction. Aluminum Company of America, Kaiser Aluminum & Chemical Corp., and Reynolds Metals Co., the three Washington producers, announced improvement and expansion plans costing over $11 million.

Pacific Lime, Inc., was constructing a lime plant at Tacoma. Barges were to bring limestone for the plant from a quarry on Texada Island, British Columbia.

Pacific Northwest Alloys, Inc., closed its Spokane ferroalloys plant at midyear because of adverse market factors. Also, the structural-steel-fabricating plant of Bethlehem Steel Co. at Seattle was closed in December because of competition from foreign steel products.

Industrial activity in Washington increased, which benefited mineral industries producing for local markets. Personal income and personal income per capita advanced 7 and 4 percent, respectively. Factory payrolls were up $155 million. Average monthly employment increased 4 percent. Nearly all the employment growth took place in the Puget Sound area, where the Century 21 World's Fair stimulated wholesale, retail, and service industries and where a sizable employment gain was registered in the aircraft industry, which reached a record high of over 76,000 workers in the summer. In the construction industry, building permit valuation and highway contract work increased, but average monthly employment dropped slightly after completion of construction at missile bases and at the World's Fair.

Imports of mineral-industry products through the Washington Customs District included crude oil by pipeline from Alberta for refineries on Puget Sound and copper ore from British Columbia for smelting at Tacoma. Exports included refined copper, aluminum ingot and mill products, and ferrous and nonferrous scrap metal.

A publication of the Washington Division of Mines and Geology described lands open to mining location in the State.[3]

The Federal Area Redevelopment Administration (ARA) let a contract for a $76,800 mineral-development feasibility study of Colville Indian Reservation lands in eastern Washington.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Materials.—Manufacturers Mineral Co., Chewelah, Stevens County, produced grinding pebbles for use at its Seattle plant. Silicon carbide, for abrasive purposes, was manufactured by Carborundum Co., Vancouver.

Barite.—Output of barite declined sharply from that of 1961. Production was by F. W. Bailor from the Monk and Favor lease in Pend Oreille County and Triton Mining Co. operations at the Uribe property in Stevens County. All barite was sold to the Kelbar Co., Tacoma.

Cement.—Combined output of portland and masonry cement declined 1 percent, and shipments were 2 percent lower than in 1961. The industry, comprised of six plants owned by four companies, operated at about 63 percent of capacity (64 percent in 1961); yearend stocks increased considerably. About 87 percent of the shipments terminated within the State, the remainder was sent to other Pacific Northwest States and Alaska. Of the total portland cement shipped, 70 percent was transported by truck, 29 percent by rail, and 1 percent by boat. The ratio of bulk to paper bag shipments was about 7:1.

[3] Moen, Wayne S. Mineral Rights and Land Ownership in Washington. Washington Div. of Mines and Geol. Inf. Circ. 36, 1962, 23 pp.

The Ideal Cement Co. cement distribution terminal at Seattle, the company's largest terminal on the west coast, was placed in operation. The 193,000-barrel storage terminal, to be filled with bulk and bagged cement from the company Grotto plant during slack seasons, was installed to supply customers during peak consumption months.

Permanente Cement Co. completed a $1 million expansion at the company Bellingham plant. Additional equipment installed included quarrying, crushing, and grinding facilities and an electrostatic dust precipitator for two wet-process kilns.

Nine cement plants in Washington and Oregon produced 7,190,325 barrels (376 pounds each) of finished portland cement; shipments from the same plants totaled 7,080,589 barrels. The average value of portland cement shipped from producing plants was $3.53 per barrel, f.o.b. plant, compared with $3.52 in 1961.

Clays.—The quantity of clays sold or used by producers in Washington decreased 31 percent, principally because of less output of miscellaneous clay for heavy clay products (building brick and draintile) and cement; smaller output of fire clay used in making refractory products (firebrick and block) contributed to the decline.

Fire clay was mined at five operations in King and Spokane Counties by International Pipe and Ceramics Corp. (formerly Gladding, McBean & Co.).

Miscellaneous clay for use in heavy clay products was obtained from nine operations in six counties. King, Spokane, and Whatcom Counties were the sources of clay used in manufacturing cement. A small quantity of bentonite was minded in Yakima County for use as a hydroseal.

Diatomite.—Quantity and value of diatomite production increased 6 and 3 percent, respectively, over the 1961 totals. Kenite Corp., Quincy, Grant County, mined and prepared diatomaceous earth for filler, insulation, and miscellaneous purposes.

Gypsum.—There was no production of gypsum. Agro Minerals, Inc., sold a small quantity of uncalcined gypsum from stocks for agricultural purposes.

Gypsum building products were made in Seattle by Kaiser Gypsum Co., Inc., from raw material mined in Baja California, Mexico. Gypsum imported from Canada was marketed by a Spokane firm for agricultural purposes.

Lime.—Captive lime was manufactured for use in sugar refining at two Utah-Idaho Sugar Co. refineries; quicklime was utilized at the Moses Lake (Grant County) plant, and hydrated lime was used at the Toppenish (Yakima County) refinery. Eight pulp mills calcined calcium carbonate sludge to lime for use in paper manufacturing.

Pacific Lime, Inc., a firm organized by Canadian interests with headquarters in Montreal, began constructing a $3 million lime plant at Tacoma. The plant, a grate-kiln system with a 6-foot 4-inch by 45-foot 8-inch traveling-grate preheater and a 10- by 110-foot rotary kiln, was designed for a capacity of 250 tons per day. The completed facility was to include an unloading dock, limestone and lime storage and recovery equipment units, a hydrating and bagging plant, and a service building. Limestone for the plant was to be barged from a quarry on Texada Island, British Columbia.

Magnesian Minerals.—Lessened demand for refractory magnesia by the steel industry resulted in a 19-percent decrease in tonnage and value of crude magnesite mined by Northwest Magnesite Co. The company retained Washington State University, Division of Industrial Research, to seek an economical process for recovering useful products from magesite flue dust recovered at the Chewelah plant.

Production of olivine, marketed principally for use as a foundry sand to consumers in the Pacific Northwest and Canada, continued to increase and was 34 percent higher than in 1961. Northwest Olivine Co. mined olivine at the Twin Sisters quarry, Skagit County, and processed the material at its Hamilton plant. Omega Mining, Inc., produced olivine at the Omega quarry, Skagit County; the material was processed at the Clear Lake plant of Northwest Talc & Magnesium Co.

Epsomite (hydrous magnesium sulfate), used as an ingredient in chemical fertilizers, was recovered by Agro Minerals, Inc., from the Poison Lake deposit, Okanogan County.

Pumice.—Output of pumice and pumiceous materials was 60 percent less than in 1961. The Grimes Co., Yakima County, prepared pumice as a pozzolan for use as a concrete admixture in constructing the Wanapum Dam. Westone Construction Products Co., Penticton, British Columbia, produced scoria from an operation in the First Creek area of Chelan County; the material was shipped to British Columbia and used as concrete aggregate.

Sand and Gravel.—Production of sand and gravel increased from 19.0 million tons ($16.1 million) in 1961 to 19.6 million tons ($18.1 million). Demand for use in highway construction and maintenance continued high.

Sand and gravel was produced in 35 of the 39 counties in the State. Output was valued at over $3 million in King County, over $2 million in both Pierce and Snohomish Counties, and over $1 million in Spokane County.

Distribution by use was road building and maintenance, 53 percent; construction, 25 percent; fill, 15 percent; railroad ballast, 2 percent; and miscellaneous, 5 percent. Included under miscellaneous were small but important quantities of special sands utilized for glass manufacturing, grinding and polishing, sandblasting, and foundry purposes.

Stone.—The quantity of stone quarried totaled 12.7 million tons valued at $18.2 million, compared with 11.5 million tons valued at $14.8 million in 1961.

Increased output was largely the result of greater requirements for materials by the U.S. Army Corps of Engineers for use in railroad and dam embankment and cofferdam construction in Klickitat County.

Stone was quarried in 35 of the 39 counties. Klickitat County led in stone output, followed by King and Snohomish Counties. Klickitat, King, and Whatcom Counties each produced more than $1 million.

Basalt, greatest in tonnage quarried, was used for concrete aggregate, roadstone, riprap, and ballast. Klickitat and King Counties had the largest output.

Limestone production from Chelan, Pend Oreille, Skagit, Stevens, and Whatcom Counties was used in manufacturing cement. Crushed limestone for agricultural purposes was produced in Snohomish County, and limestone from Stevens County was used at paper mills,

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Building	4,250	$4,502	4,699	$5,373
Road material	4,156	3,871	5,338	5,167
Fill	2,743	1,204	1,542	723
Railroad ballast	193	109	375	263
Other [1]	183	322	832	1,102
Total	11,526	10,007	12,786	12,628
Government-and-contractor operations:				
Building	422	415	171	228
Road material	5,858	5,106	5,149	4,504
Fill	1,089	538	1,361	683
Other [1]	99	79	113	102
Total	7,468	6,138	6,794	5,517
All operations:				
Building	4,672	4,917	4,870	5,601
Road material	10,014	8,977	10,487	9,672
Fill	3,832	1,742	2,903	1,406
Railroad ballast	193	109	375	263
Other [1]	283	400	945	1,203
Grand total [2]	18,994	16,145	19,580	18,145

[1] Includes special sands for construction and industrial uses and sand and gravel for miscellaneous unspecified purposes.
[2] Owing to rounding, individual items may not add to totals shown.

TABLE 6.—Stone sold or used by producers, by uses

(Thousand short tons and thousand dollars)

Use	1961		1962	
	Quantity	Value	Quantity	Value
Dimension stone (building)	8	$281	15	$403
Concrete and roadstone	6,743	7,417	8,554	9,940
Riprap	3,307	4,348	2,614	4,656
Railroad ballast	(1)	(1)	169	233
Other [2]	1,406	2,712	1,397	2,948
Total [3]	11,464	14,758	12,749	18,180

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Used at cement, paper, metallurgical, and chemical plants; sugar refineries; and for miscellaneous unspecified purposes, and items indicated by footnote 1.
[3] Owing to rounding, individual items may not add to totals shown.

at metallurgical plants, and for building purposes. A report [4] was published on eastern Washington limestone deposits.

Crushed marble for roofing granules, terrazzo chips, and agricultural purposes; marble whiting for fertilizer filler; and dimension stone were products from marble-quarrying operations in Stevens County.

Dimension granite was quarried in Spokane County. Granite quarried in Chelan, Douglas, Ferry, King, and Spokane Counties was used for roadstone, riprap, and poultry grit.

[4] Mills, Joseph W. High Calcium Limestone of Eastern Washington. Washington State Div. of Mines and Geol. Bull. 48, 1962, 268 pp.

Sandstone was quarried for facings and flagging (Ferry, Kittitas, Lewis, and Stevens Counties) and as rough blocks (Ferry and Pierce Counties). Sandstone, quartz, and quartzite for use as industrial silica were produced in Pend Oreille, Spokane, and Stevens Counties; the output was used by the cement, glass, metallurgical, and chemical industries.

Talc and Soapstone.—Tonnage of soapstone output declined 3 percent, and value was about half of the 1961 total. Mining was limited to Skagit County, where two operators near Marblemount produced raw material for grinding at the Clear Lake grinding plant of Northwest Talc & Magnesium Co. The main use for the ground material was as a carrier in insecticides; a small quantity was sold for paint filler.

Vermiculite (Exfoliated).—Crude vermiculite mined in Montana was exfoliated at the Spokane plant of Vermiculite Northwest, Inc. Output of the finished product, marketed principally for installation and lightweight plaster and concrete aggregates, was slightly less than in 1961.

METALS

Aluminum.—Production of primary aluminum (which rose from the lowest in 3 years in 1961 to the highest in 5 years) was 371,757 tons valued at $178.2 million, compared with 331,264 tons valued at $168.9 million in 1961. This was an increase to 12 percent in tonnage and 6 percent in value.

The rising market demand for aluminum caused the three primary producers to announce expansion plans which totaled over $11 million. Two of the three producers also reactivated a potline.

Aluminum Company of America reactivated a potline at the Wenatchee plant, placing three or four in operation and boosting output capacity 27,000 tons to a total of 81,000 tons per year. Expansion plans at Wenatchee called for new extrusion-ingot-casting equipment, using the direct-chill process, costing $400,000. The company planned to invest $1.5 million in expanding the Vancouver plant—$0.5 million for additional equipment for extrusion- and sheet-ingot production and $1 million for new fabrication facilities. Fabrication expansion included the purchase of a third extrusion press, additional wire-drawing equipment, and auxiliary finishing and handling equipment.

TABLE 7.—Primary aluminum plant capacity and production data

Year	Rated primary capacity (short tons)	Primary production			Average U.S. ingot, price per pound (cents)
		Short tons	Percent of national total	Value (thousands)	
1953–57 (average)	449,000	443,220	29	$198,539	24.0
1958	483,000	311,417	20	156,376	26.9
1959	483,000	333,615	17	165,423	26.9
1960	483,000	346,126	17	181,138	[1] 26.0
1961	483,000	331,264	17	168,921	25.5
1962	483,000	371,757	18	178,226	23.9

[1] Price of pig now applied to ingot. The use of the term "pig" was discontinued in August 1960.

Reactivation of the seventh potline (of a total of eight) gave the Kaiser Aluminum & Chemical Corp. Mead reduction plant a rated output of 154,000 tons annually. Improvement and expansion in this plant was to be in extrusion-ingot production, in the remelting furnaces and allied equipment for casting of special aluminum products, and in a new carbon-baking furnace and auxiliary equipment to produce carbon anodes. The Trentwood rolling-mill melting facilities were to be modernized completely and a new heat-treating annealing installation was to be built. The total cost of expansion to be completed in 1963 at both plants was to be $8 million. Kaiser also submitted, near yearend, a successful bid to the General Services Administration (GSA) for the purchase of a Government-owned plant previously leased by Pacific Northwest Alloys, Inc., at Mead. Kaiser planned to produce calcined coke at a rate of 50,000 tons annually using raw petroleum coke from Pacific Northwest refineries. The calcined coke, used in producing aluminum, was to replace material the firm obtained from the Eastern United States.

A 20-year lease by Reynolds Metals Co. supported financing of the port of Longview $1.3 million expansion of dock facilities. The expansion included a wharf and two silo-type storage tanks which were to be used for unloading and storing alumina. Approximately 300,000 tons of alumina per year was to be shipped from Corpus Christi, Tex., by means of two converted tankers. This shift from rail to ocean freight would mean a substantial saving by Reynolds in freight charges.

According to the U.S. Department of Commerce, aluminum mill products (produced mainly by Washington producers) were exported to 31 countries through the Oregon and Washington Custom Districts. Five countries (India, the United Kingdom, Thailand, France, and Colombia) accounted for 77 percent of total exports. Of the 10,225-ton total, plate and sheet accounted for 4,118 tons, bar and rods 3,783 tons, bare wire and cable 2,192 tons, extruded shapes 105 tons, and not elsewhere classified 27 tons.

A report [5] was published on the Pacific Northwest aluminum industry.

Copper.—Lead-zinc mining in Pend Oreille County yielded as a by-product, most of the 41 tons of copper output. A small amount of copper ore was produced by Kromona Consolidated Mines, Inc., Kromona mine, Snohomish County.

A copper-exploration project (surface trenching and underground work) in the Squaw Creek district, Okanogan County, was approved by the Office of Minerals Exploration (OME). The project was to be executed by Paymaster Mines, Inc., of Pateros, and Government participation was to be $32,455 of a total cost of $64,910.

Ferroalloys.—Ohio Ferro-Alloys Corp., Tacoma, and Keokuk Electro-Metals Co., Wenachee, produced ferrosilicon and silicon metal. Ferrosilicon and ferrochrominum (from African chromite concentrates) were produced at the Pacific Northwest Alloys, Inc., Mead plant (near Spokane) in the first half of 1962. At midyear the company closed the plant because of the cost of shipping finished products

[5] Fulkerson, Frank B. Trends and Outlook in the Pacific Northwest Aluminum Industry. BuMines Inf. Circ. 8046, 1962, 42 pp.

to markets in the Midwest and East. By yearend, the plant was purchased by Kaiser Aluminum & Chemical Corp. from GSA.

A regional study of the ferroalloy industry in the Pacific Northwest was published.[6]

Gold.—Output of gold decreased 20 percent below that of 1961. Knob Hill Mines, Inc., Ferry County, and L–D Mines (formerly Lovitt Mining Co.), Chelan County, produced 99.9 percent of the output. L–D Mines completed a 300-ton-per-day concentrator and achieved full production tonnages and recoveries by yearend. Most of the ore mined was milled, and the concentrate was shipped to The Bunker Hill Co. smelter at Kelogg, Idaho; a minor quantity of ore for silaceous flux was shipped to the American Smelting and Refining Company smelter at Tacoma.

Two small placer operations in Clallam and Snohomish Counties produced a few ounces of gold.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in terms of recoverable metals[1]

Year	Mines producing		Material sold or treated[2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1953–57 (average)	25	2	1,632	(3)	(3)	(3)	(3)
1958	14	3	975	(3)	(3)	(3)	(3)
1959	15	1	958	(3)	(3)	(3)	(3)
1960	17	----	1,070	(3)	(3)	(3)	(3)
1961	15	3	1,103	(3)	(3)	(3)	(3)
1962	20	2	958	(3)	(3)	(3)	(3)
1860–1962	----	----	(4)	[5] 2,844,331	[5] $78,307	[5] 16,391	[5] $12,333

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1953–57 (average)	3,192	$2,151	11,147	$3,201	26,847	$6,442	$14,696
1958	52	27	9,020	2,111	18,797	3,835	10,469
1959	49	30	10,310	2,371	17,111	3,936	10,986
1960	78	50	7,725	1,808	21,317	5,500	12,388
1961	66	40	8,053	1,659	20,217	4,650	10,986
1962	41	25	6,033	1,110	21,644	4,978	9,733
1860–1962	122,000	43,297	222,000	50,681	461,000	104,350	314,936

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, and ore shipped to smelters during calendar year indicated. Because of rounding, individual items may not add to totals shown.
[2] Does not include gravel washed.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] 1860–1903 data not available; 1904–1962, 32,399,849 short tons.
[5] Excludes 1957–62.

Iron Ore.—No production was reported. Elektrokemisk A/S, Oslo, Norway, was investigating the metallurgical feasibility of producing iron by electric-arc smelting of ores from Buckhorn Mountain, northwest of Spokane, and from the Potlatch (Idaho) area. The two properties were acquired in 1961 by Zontelli Bros., Ironton, Minn.

[6] Kingston, Gary A. The Pacific Northwest Ferroalloy Industry. BuMines Inf. Circ. 8050, 1962, 26 pp.

Lead.—The lowest in 12 years, lead output was 6,033 tons and $1.1 million in value. Production was principally (98 percent) from three mines in Pend Oreille County—American Zinc, Lead and Smelting Co. Grandview and Mineral Right mines and Pend Oreille Mines and Metals Co. Pend Oreille Mine.

Lessees of the Gladstone Mining Co. Gladstone mine, Stevens County, and Lucky Joe Mining Co. Lucky Joe mine, Pend Oreille County, produced a small quantity of high-grade lead ore. Delles & Sullivan Mining Co. (several leases in Stevens County) and Clayloon Uranium, Inc. (Lead Trust mine, Stevens County), produced a minor amount of lead concentrate. All of the lead concentrate and most of the lead ore produced from these operations were shipped to the Bunker Hill smelter at Kellogg, Idaho.

Silver.—Production and value of silver was the lowest in 8 years, and decreased 44 and 35 percent, respectively, below the 1961 totals. Gold- and silver-mining operations accounted for 91 percent of the output. The silver-to-gold ratio was 3.71 to 1. Lead-zinc operations accounted for most of the remainder, with an average of 5.2 ounces of silver per ton of lead.

As in previous years, Knob Hill Mines, Inc. (Knob Hill and Gold Dollar mines, Ferry County) produced most of the silver.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1962, by classes of ore or other source material, in terms of recoverable metals

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold and gold-silver[2]	5	121,338	(3)	(3)	400	----------	----------
Dry silver	4	1,945	(3)	(3)	200	29,100	----------
Copper	2	376	(3)	(3)	10,100	----------	2,200
Lead	5	1,067	--------	(3)	600	225,700	2,500
Lead-zinc	3	829,655	--------	(3)	70,400	11,801,700	42,859,400
Zinc	3	3,208	(3)	(3)	300	9,500	423,900
Total	20	957,589	(3)	(3)	82,000	12,066,000	43,288,000
Placer	2	(4)	(3)	(3)	----------	----------	----------
Grand total	22	957,589	(3)	(3)	82,000	12,066,000	43,288,000

[1] Detail will not necessarily add to total, because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] 38 cubic yards of gravel washed.

Steel.—Bethlehem Steel Co., Pacific Coast Division, reduced prices on products made at the Seattle plant by the following amounts—$16 per ton on plate, $13 on structurals, and $8 to $12 on other steel products—because of imports and because Kaiser Steel Corp. lowered the price of steel produced at its Fontana, Calif., plant. Imports also were a prime factor in closing the Bethlehem Steel Co. Seattle structural-steel-fabricating plant near yearend.

Steel distributors and consumers in western Washington won a freight rate reduction of $1 per ton on steel shipped from Geneva, Utah, and Fontana, Calif. Portland, Oreg., and eastern Washington continued to have a preferential freight rate of over $1 per ton.

A report was published on the Pacific Northwest steel industry.[7]

Tin.—Silver Hill Mines, Inc., shipped about 2 tons of tin concentrate valued at about $3,000 from the Silver Hill mine near Spokane to the Wah Chang Corp. smelter at Texas City, Tex. This was the second recorded shipment of tin concentrate from the Pacific Northwest. The concentrate was produced from a dump built up in the early 1900's as the result of sinking a 130-foot exploratory shaft on a tin-bearing vein discovered in 1907.

Tungsten.—There was no production of tungsten recorded in 1962. Silver Hill Mines, Inc., had made one shipment of concentrate late in 1961.

Uranium.—As stated in the Newmont Mining Corp. annual report, Dawn Mining Co. (51 percent owned by Newmont Mining Corp. and 49 percent by Midnite Mines, Inc.) milled 110,949 tons of uranium ore, compared with 174,961 tons in 1961. Sales of uranium oxide (U_3O_8) to the U.S. Atomic Energy Commission (AEC) totaled 547,884 pounds, against 440,428 pounds in 1961. In November, AEC announced a new policy which would allow sale contracts to be extended through 1970 if present agreements were amended to defer certain quantities beyond 1966 at reduced prices. Dawn negotiated with AEC for such an extension.

Zinc.—Obtained mainly from lead-zinc ores mined in northeastern Washington, zinc output, totaled 21,644 tons valued at $5 million, compared with 20,217 tons valued at $4.7 million in 1961.

Triton Mining Co., Spokane, assigned control of its Shumaker mine and adjacent leases in Stevens County to Tri-Nite Mining Co. for shares of Tri-Nite stock, cash, and a 5-percent royalty on future Shumaker production. Tri-Nite also acquired four leases, covering 800 acres adjoining the Shumaker property, by an exchange of stock. Later in 1962, the company excavated a millsite and poured concrete foundations in preparation for moving machinery from the Goldfield Consolidated Mining Co. mill near Aladdin to the Shumaker mine.

MINERAL FUELS

Carbon Dioxide.—Recovery of carbon dioxide by Gas-Ice Corp. operations in Klickitat and Benton Counties declined 3 percent from that of 1961. The company recovered carbon dioxide from mineral waters in Klickitat County and from an ammonia-plant waste product at the Finley plant (Benton County).

Coal (Bituminous).—Eight underground operation and one strip mine yielded 234,957 tons of coal, about 44,200 tons more than in 1961. Kittitas County led in coal production, followed in descending order by King, Thurston, and Lewis Counties.

A contract to supply 120,000 tons of coal (based on 10,000 btu per pound) to the Hanford Atomic Works was awarded to the Northern Pacific Railway Co. The company supplied coal from its Roslyn mines (Kittitas County) for Hanford use. The first step—extracting coal pillars, formed by conventional mining, through the use of high-pressure jets of water—in the hydraulic-coal-mining study at Roslyn by the Bureau of Mines was concluded early in 1962. The study was

[7] Kingston, Gary A., and Frank B. Fulkerson. The Pacific Northwest Steel Industry. BuMines Inf. Circ. 8073, 1962, 45 pp.

continued, and tests were to be conducted to determine if solid coal or development adits could be mined using the high-pressure equipment.

Negotiations continued between interested parties relative to a proposed coal-fired steam plant for generating electrical energy at Lake Cle Elum in Kittitas County. The county Public Utility District held an option to purchase the Northern Pacific Railway Co. Roslyn operations to be used in the project.

Coke.—Kaiser Aluminum & Chemical Corp. purchased the idle Government-owned metals reduction plant at Mead from GSA. The plant was to produce calcined coke using raw petroleum coke from Pacific Northwest refineries. Scheduled output was to be 50,000 tons of calcined coke per year.

Peat.—Production of peat was 42,762 short tons from 16 operations. Sales totaled 41,962 tons, of which 34,462 tons valued at $138,215 was sold in bulk and 7,500 tons valued at $150,000 was packaged for sale.

Snohomish County (four operations) led in peat production, followed by King (seven operations), Kitsap (three operations), and Thurston and Pierce (one operation each).

Humus was produced at 12 operations, 3 sites yielded moss peat, and 4 bogs yielded reed-sedge peat.

Petroleum and Natural Gas.—The State of Washington held three lease auctions offering submerged State land. Texaco, Inc., Union Oil Co., and Humble Oil & Refining Co. took leases on several thousand acres of submerged land, but most of the offshore leases went to Superior Oil Co.

TABLE 11.—Value of mineral production in Washington, by counties[1]

Company	Well	Total depth (feet)	County
Union Oil Co. of California	State Tidelands No. 1	870	Grays Harbor.
Do.	State Tidelands No. 1A	1,176	Do.
Standard Oil Co. of California	Pope and Talbot No. 3-1	4,375	Island.
Humble Oil & Refining Co.	Everett Trust & Savings Bank Trustee et al. C-1.	4,309	Lewis.
Do.	Roscoe B. Perry et ux	10,708	Do.
Can-American Petroleums Corp., Ltd.	Can-Am Lynden or Stremler No. 1	7,865	Whatcom.
El Paso Natural Gas Co.	Ross No. 1	4,707	Do.

Source: Washington Division of Mines and Geology.

Exploration interest was focused primarily on offshore Grays Harbor County where Union Oil Co. drilled the 1-A State Tidelands, which was the first offshore well in the Pacific Northwest. The stratigraphic test, about 2 miles offshore from the Ocean City area, was abandoned at 1,176 feet in September. Difficult operating conditions were encountered in drilling from a floating barge; large ground swells prevented the company from finishing any of the offshore holes planned. The second offshore well, the State Tidelands No. 1, was abandoned at a depth of 870 feet, and a third attempt was abandoned when a storm threatened the loss of the barge.

Inland drilling activity was centered near Chehalis (Lewis County), Bellingham (Whatcom County), and Greenbank (Island County). East of Chehalis, Humble Oil & Refining Co. drilled the C-1 Everett

Trust & Savings Bank Trustee, et al., to a depth of 4,309 feet. The company abandoned the Roscoe B. Perry, about 8 miles southwest of the C–1 Everett, at a depth of 10,708 feet. Can-American Petroleums Corp., Ltd., drilled a 7,865-foot basement test (Can Am Lynden or Stremler No. 1) near the Canadian border. El Paso Natural Gas Co. made a 4,707-foot stratigraphic test of a structure near Squalicum Mountain (Ross No. 1). South of Greenbank in Island County, Standard Oil Co. of California drilled the Pope and Talbot No. 3–1 to a depth of 4,375 feet.

REVIEW BY COUNTIES

Mineral production was reported from 38 of the 39 counties. With certain important exceptions, output was principally from nonmetallic deposits. Only selected counties with significant metal and nonmetal developments are discussed in the following review.

TABLE 11.—Value of mineral production in Washington, by counties [1]

(Thousand dollars)

County	1961	1962	Minerals produced in 1962 in order of value
Adams	$455	$194	Sand and gravel, stone.
Asotin	23	16	Sand and gravel.
Benton	179	108	Stone, sand and gravel.
Chelan	1,254	1,043	Gold, stone, sand and gravel, silver, pumice, copper.
Clallam	163	242	Sand and gravel, stone, gold.
Clark	[2] 992	560	Stone, sand and gravel, clays.
Cowlitz	[2] 218	158	Sand and gravel, stone.
Douglas	237	217	Do.
Ferry	[3]	[3]	Gold, silver, stone, copper.
Franklin	1,508	874	Sand and gravel, stone.
Garfield	118	102	Stone.
Grant	1,242	1,687	Stone, diatomite, sand and gravel, lime.
Grays Harbor	389	352	Sand and gravel, stone.
Island	47	393	Sand and gravel.
Jefferson	[2] 472	337	Stone, sand and gravel.
King	8,578	11,363	Cement, sand and gravel, stone, coal, peat, clays.
Kitsap	269	219	Sand and gravel, stone, peat.
Kittitas	1,002	1,373	Coal, sand and gravel, stone.
Klickitat	1,560	4,290	Stone, sand and gravel, carbon dioxide.
Lewis	466	618	Stone, sand and gravel, coal.
Lincoln	315	318	Stone, sand and gravel.
Mason	17	15	Sand and gravel, stone.
Okanogan	495	126	Sand and gravel, stone, epsomite, silver, copper, gold, lead.
Pacific	1,053	303	Stone, sand and gravel.
Pend Orielle	8,417	[3]	Zinc, cement, lead, stone, sand and gravel, silver, copper, barite, uranium.
Pierce	[2] 3,522	3,402	Sand and gravel, stone, clays, peat, coal.
San Juan	176	5	Sand and gravel.
Skagit	2,794	3,323	Cement, stone, olivine, sand and gravel, talc and soapstone.
Skamania	160	341	Stone, sand and gravel.
Snohomish	[2] 2,966	4,106	Sand and gravel, stone, peat, clays, copper, gold, silver.
Spokane	4,481	3,540	Cement, sand and gravel, stone, clays, uranium.
Stevens	5,163	3,938	Uranium, stone, magnesite, sand and gravel, zinc, lead, barite, silver, clays, copper, grinding pebbles, gold.
Thurston	228	469	Stone, sand and gravel, coal, peat.
Wahkiakum	[3]	116	Stone.
Walla Walla	[2] 1,197	855	Sand and gravel, stone.
Whatcom	[3]	[3]	Cement, stone, sand and gravel, clays.
Whitman	304	437	Stone, sand and gravel.
Yakima	1,630	1,798	Sand and gravel, stone, pumice, lime, clays.
Undistributed [4]	[2] 14,358	21,236	
Total	[2] 66,448	68,474	

[1] No production reported in Columbia County.
[2] Revised figure.
[3] Figure withheld to avoid disclosure of individual company confidential data; included with "Undistributed."
[4] Includes value of mineral production that cannot be assigned to specific counties and values indicated by footnote 3.

Chelan.—Limestone from the Soda Springs quarry near Leavenworth was shipped to the Grotto plant (King County) of Ideal Cement Co.

L–D Mines (Gold King mine) was active throughout 1962. During the first 6 months, a 300-ton-per-day concentrator for gold-silver ore was erected and placed in operation. Development work included 1,402 feet of new workings and 3,228 feet of test drilling.

Clark.—Hidden Brick Co., Vancouver, and Ridgefield Brick & Tile Co., Ridgefield, produced clay for building brick and draintile.

Aluminum Company of America shipped 500 tons of aluminum transmission cable to Thailand for transmitting power from the nearly completed Yam Hee Dam.

Cowlitz.—Reynolds Metals Co. continued to operate its Longview aluminum-reduction plant at full capacity.

Douglas.—Keokuk Electro-Metals Co. ferrosilicon and silicon metal plant at Wenatchee was operated most of 1962 at 50 percent of rated capacity.

Ferry.—According to the Day Mines, Inc., annual report, development work, which was concentrated on properties adjoining the Gold Dollar and Knob Hill mines (Knob Hill Mines, Inc.), totaled 1,493 feet of new workings and 2,676 feet of core drilling. The new ore developed by this work offset the tonnage mined from the Gold Dollar ore body.

The Area Redevelopment Administration let a $76,800 contract for a mineral-development feasibility study on the Colville Indian Reservation.

King.—The county was the principal nonmetal-producing county in the State. Value of output exceeded the 1961 value by $2.8 million.

Production of cement increased at both the Seattle plant of Lone Star Cement Corp. and the Grotto plant of Ideal Cement Co. A 193,000-barrel cement distribution terminal began operating at Seattle.

International Pipe and Ceramics Corp. produced fire clay from the Blum pit for firebrick and block. The company Palmer, Renton, Preston, and Number 55 Sand pits yielded clay for heavy clay products. Builders Brick Co. mined clay at the Elk and Newcastle pits for building brick and draintile. Ideal Cement Co. dug clay at the Grotto pit for its cement-making process.

Palmer Coking Coal Co., Inc., supplied most of the coal production from the Rogers, Rogers No. 2, and Franklin No. 12 mines. A small quantity of coal was mined at the Newcastle (B & R Coal Co.) and Black Knight (Coal, Inc.) mines.

A zinc residue recovered as flue-dust at the Bethlehem Steel Co., Pacific Coast Division, Seattle plant was shipped to the Bunker Hill smelter at Kellogg, Idaho. This residue yielded secondary silver, copper, lead, and zinc.

Kittitas.—The county maintained its position as the leading source of coal. Output from underground and stripping operations at the Roslyn No. 9 mine of Northern Pacific Railway Co. accounted for 73 percent of the State total.

Okanogan.—Epsomite was mined near Tonasket (Poison Lake) by Argo Minerals, Inc. A gypsum operation owned by the company in the same area was idle.

Pend Oreille.—The Metaline Falls plant of Lehigh Portland Cement Co. was the principal nonmetallic industry in the county. Cement production by the company decreased 30 percent in contrast to a 6-percent decrease in shipments, compared with 1961.

American Zinc, Lead and Smelting Co. stated in its annual report that its Washington mines (Grandview and Mineral Right) produced 12,405 tons of lead and zinc concentrates, compared with 14,977 tons in 1961. Output was reduced at both mines because production labor was diverted to development projects.

Pend Oreille Mines and Metals Co., as stated in its annual report, milled 619,946 tons of ore, compared with 742,934 tons in 1961. Selective mining upgraded the mill heads by 10 percent, but the tonnage milled was reduced and operating costs increased. Underground development consisted of 5,543 feet of drifting and raising, 69,764 cubic feet of station excavation, and 47,719 feet of diamond and long-hole percussion drilling.

Pierce.—Again sand and gravel production was the highest in the State. Fourteen operators working 18 pits produced 3.8 million tons of sand and gravel valued at $2.5 million. Output was used mainly for building purposes and road construction.

Pacific Lime, Inc., a division of Dominion Tar & Chemical Co., Ltd., finished construction of a 250-ton-per-day-capacity lime plant at Tacoma.

Skagit.—The Lone Star Cement Corp. plant at Concrete was the major mineral industry in the county; output was 30 percent higher than in 1961. Olivine mined at the Twin Sisters quarry about 20 miles north of Hamilton was trucked to the Northwest Olivine Co. Hamilton plant for processing. The Omega quarry yielded olivine for processing at the Northwest Talc & Magnesium Co. custom grinding plant at clear Lake. Soapstone was mined at deposits near Marblemount by Herman Smith and Skagit Talc Products.

Snohomish.—The county continued to be the principal peat-producing area in Washington. Reed-sedge peat was produced by Great Northern Pacific Peat Co. and Rhod-A-Zalea Gardens. Humus was obtained from Bassetts Grow Earth and Joe LaRoche Topsoil & Peat Co. Lowell Brick & Tile Co. used locally mined clay to make building brick.

Miller Lime Co. (Haystack quarry) and Western Lime Co. (Bryant quarry) marketed limestone for agricultural purposes. Darrington Mining & Milling Co. mined a small quantity of travertine from the Whitechuck quarry for agricultural purposes.

Ridge Mining Corp., a Kennecott Copper Corp. subsidiary, assumed control of the Glacier Peak copper property from Bear Creek Mining Co., another Kennecott subsidiary. The Bear Creek firm had conducted an extensive exploration of the property for several years.

Spokane.—Nonmetallic mineral production was valued at $3.5 million, compared with $4.5 million in 1961. The decrease, largely the result of less cement output, caused the county to drop to fifth place in value of nonmetals. The Irvin plant of Ideal Cement Co., despite a 3-month shutdown caused by reduced demand for its product, continued to be the principal nonmetallic industry in the county. Clay mined locally and limestone from the Stevens County Limerock quarry supplied raw materials for the operation.

International Pipe and Ceramics Corp. produced clay from the Adams and Mica pits and from the Sommer lease. Fire clay refractories and other clay products were made at the company Mica plant. Greenacres Gypsum Co. marketed gypsum from Canada for agricultural purposes.

Silver Hill Mines, Inc., closed its tungsten and tin mine and mill (5 miles south of Spokane) early in 1962 after making one shipment of tin concentrate to the Wah Chang Corp. smelter at Texas City, Tex.

Daybreak Uranium Co. (Dahl lease) shipped 238 tons of uranium ore containing 704 pounds of U_3O_8 to the Dawn Mining Co. mill at Ford.

Stevens.—Magnesite mining at the Red Marble quarry of Northwest Magnesite Co. supplied the largest part of the county nonmetallic mineral output value.

Limestone was produced by Columbia Rock Co. (Evans quarry), Ideal Cement Co. (Limerock quarry), Peter Janni & Sons (Janni quarry), Northport Limestone Co. (Sherve quarry), and W. H. West (Bone Pit Quarry). Output was utilized for manufacturing cement (Limerock quarry), as a metallurgical flux (Evans, Janni, and Sherve quarries), by the paper industry (Janni and Sherve quarries), for agricultural purposes (Sherve quarry), in making stucco (Janni quarry), and for exterior building purposes (Bone Pit quarry).

Marble was produced by W. A. Madsen (Madsen quarry), Manufacturers Mineral Co. (June Echo Copper quarry), Everett Merrill (Denny lease), North American Non-Metallics (Na-No-Me quarries), and Northwest Marble Products Co. (Northwest Marble quarry). Output was utilized for exterior building purposes (Madsen, Denny, and Na-No-Me quarries), marble whiting (Na-No-Me quarries), terrazzo chips and roofing granules (Na-No-Me and Northwest Marble quarries), and stucco (June Echo Copper and Na-No-Me quarries).

Siliceous materials were produced by Lane Mountain Silica Co. (for glass making, foundry purposes, manufacturing sodium silicates, and sandblasting), Manufacturers Mineral Co. (for grinding pebbles and filter material), and Lovejoy Mining and Leasing Co. (for exterior building purposes).

Ninety-nine percent of the State uranium ore production was credited to Dawn Mining Co. Of the total output, 107,759 tons came from the Midnite mine and 2,797 tons from the nearby Peters lease.

Whatcom.—The county ranked second in value of nonmetallic mineral commodities. The Permanente Cement Co. plant at Bellingham, the leading nonmetallic mineral industry in the county, continued to produce the most cement in the State. The plant used limestone from the company Kendall quarry near Maple Falls.

Yakima.—Pumicite mined by Grimes Co. from the Sunnyside quarry was used as a pozzolan material. A small quantity of bentonite was produced by West Brothers Construction Co. near Naches for sealing irrigation canals.

The Mineral Industry of West Virginia

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the West Virginia Geological and Economic Survey for collecting information on all minerals except fuels.

By James R. Kerr,[1] and Jean Pendleton[2]

RENEWED activity in the coal industry set the pace in the 4 percent rise in value of mineral production in West Virginia in 1962. There was increased demand for open-market coal, but captive coal output was slightly lower than in 1961. Production of petroleum and natural gas also increased. A record number of gas and oil wells were drilled during the year. Slackening in the roadbuilding program reduced consumption of roadstone and aggregate, depressing the crushed stone industry. The refractory market for the clay and lime industries continued poor because the steel industry did not resume large-scale refractory use. McDowell, Logan, Wyoming, Marion, Kanawha, Raleigh, Monongalia, Nicholas, Harrison, and Boone Counties led in value of mineral production.

TABLE 1.—Mineral production in West Virginia[1]

Mineral	1961		1962	
	Quantity	Value (thousand)	Quantity	Value (thousand)
Clays—thousand short tons	475	$2,193	447	$2,086
Coal (bituminous)—do	113,070	558,525	118,499	578,293
Natural gas—million cubic feet	210,556	57,692	210,698	57,942
Natural gas liquids:				
Natural gasoline—thousand gallons	34,095	2,296	32,921	2,216
LP gases—do	342,646	17,826	344,969	17,475
Petroleum (crude)—thousand 42-gallon barrels	2,760	11,426	[2] 3,345	[2] 13,380
Salt—thousand short tons	899	3,510	1,042	4,635
Sand and gravel—do	4,882	10,152	5,202	10,942
Stone—do	7,628	13,244	[3] 7,506	[3] 13,242
Value of items that cannot be disclosed: Bromine (1961), calcium-magnesium chloride, cement, gem stones, lime, and stone (dimension sandstone)	----	13,385	----	14,753
Total	----	[4] 690,249	----	714,964

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Preliminary figure.
[3] Excludes certain stone, included with "Value of items that cannot be disclosed."
[4] Revised figure.

[1] Mining engineer, Bureau of Mines, Pittsburgh, Pa.
[2] Statistical clerk, Bureau of Mines, Pittsburgh, Pa.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Production of coal increased 5 percent to 118.5 million tons. The increase was in sales, because captive production decreased slightly from 1961. The increase of 60 in the number of active mines brought the total to 1,706.

Of total State production, 92 percent was mined at 1,467 underground mines, 5 percent was mined at 135 strip mines, and 3 percent was mined at 104 auger mines. The average value per ton decreased from $4.94 to $4.88. Cost cutting was accomplished by closing marginal mines and opening new mechanized mines which required fewer men.

Of the underground production, 91 percent was mechanically loaded. Continuous mining increased again in 1962. Forty-five more continuous miners began operating, bringing the total to 381. Continuous miners loaded 39 percent of the mechanically loaded tonnage. However, mobile loading machines continued to be the most common mechanical loading device; 847 machines were active (61 fewer than in 1961), loading 60 percent of the mechanically loaded output. Of the 381 continuous-mining machines in operation, 131 loaded onto conveyors and 250 loaded into shuttle cars. In addition, 124 mobile loading machines were used in conjunction with the continuous miners. The balance of the mechanically loaded tonnage was handled by 246 hand-loaded face conveyors, 51 fewer than in 1961.

Other equipment at underground mines included 1,595 cutting machines, 2,243 handheld and post-mounted drills, 132 mobile drills, and 743 rotary and 379 percussion roof-bolting and rock drills.

The following equipment was used at strip mines; 242 power shovels, 10 draglines, 9 carryall scrapers, 241 bulldozers, 67 horizontal drills, 51 vertical drills, and 491 trucks that averaged 15 tons in capacity and traveled 7 miles to the tipple on the average. Equipment used at auger mines included 105 augers, 11 power shovels, 87 bulldozers, 2 horizontal drills, and 152 trucks that averaged 16 tons in capacity and traveled 6 miles from pit to tipple on the average. Transportation from the tipple was chiefly by rail or water (94 percent) and the balance was by truck (4 percent) and other methods (2 percent).

There was no change in the number of cleaning plants, and 152 plants cleaned 75 percent of the total output. Of the total cleaned, 37 percent was by jigs, 55 percent by wet washing other than jigs, and 8 percent by pneumatic methods. Thirty-two percent of total output was crushed, and 15 percent was treated (83 percent with oil, 8 percent with a combination of calcium chloride and oil, 3 percent with calcium chloride, and 6 percent with other materials).

According to preliminary data, there were 75 fatal and 4,355 nonfatal injuries in West Virginia coal mines in 1962, compared with 87 fatal and 4,155 nonfatal injuries in 1961. Injury rates were 1.13 fatal and 65.78 nonfatal injuries per million man-hours. Total man-hours worked decreased from 69,277,734 to 66,210,000, and the average number of workers decreased from 44,240 to 42,400. Productivity

increased to 14.1 tons per man-shift, compared with 12.9 tons per man-shift in 1961.

At underground mines, falls of roof were the usual largest single cause of fatalities. In 1962, 39 men were killed by falls of roof, 15 in haulage accidents, 7 by other machinery, 2 by electricity, 2 by explosives, and 1 by gas or dust explosion. At surface operations associated with underground mines, three men were killed in haulage accidents, one by machinery, and two by other causes. Of the three fatalities occurring at strip mines, one was caused by machinery and two by other causes. There were no fatal accidents in the State's auger mines.

A contract for installation of a full-scale coal injection system on a blast furnace has been awarded to Koppers Co. by the Weirton Steel Co., Division of National Steel Corp. A unique coal-feeding device, which was developed by Bituminous Coal Research, Inc., would be used at the installation. This would be the first commercial application of the device, which feeds crushed coal into a stream of pressurized air.[3]

Continuing efforts were noted in the competitive struggle to reduce the cost of transporting coal from mine to market. The "integral" train, coal pipeline, and mine-mouth power generation with subsequent long-distance extra-high-voltage transmission were among the steps being taken to reduce transportation costs. Significant in the "integral" train concept was a trial shipment from West Virginia to Merrimack Power Station in New Hampshire. This marked the first direct rail shipment from mines in the State to New England. Plans were being made for other integral trains from the State to the east coast. The "coal by wire", or extra-high-voltage transmission, technique received impetus when plans were announced for the construction of a 500,000-kilowatt powerplant by Allegheny Power System on the Monongahela River near Morgantown. Anticipated coal consumption at the plant was 1.35 million tons per year.[4]

Successful research was announced by Dravo Corp. in the effort to market economically the coal fines that were becoming increasingly prevalent in preparation flowsheets. A method of pelletizing fine coal of widely varying particle sizes and moisture content was demonstrated, and experimentation was continuing.[5]

Coke and Coal Chemicals.—Three oven coke plants, with 668 ovens, produced 2,610,010 tons of coke, 3 percent less than in 1961. The total value of coke produced was $43.9 million. The average unit value of $16.83 per ton was $0.47 per ton less than in 1961. A total of 3,874,413 tons of coal was carbonized at an average yield of 67.4 percent. Recovered products at the oven coke plants included 214,598 tons of coke breeze (a yield of 5.54 percent per ton of coal), 43.6 billion cubic feet of coke oven gas, 39,291 tons of ammonium sulfate equivalent, 40,413,763 gallons of coke-oven tar, and 11,590,660 gallons of crude light oil from which was derived 7,146,589 gallons of benzene, 2,037,744 gallons of toluene, 668,861 gallons of xylene, and 159,810 gallons of solvent naphtha (crude and refined).

[3] American Metal Market. V. 69, No. 112, June 12, 1962, p. 4.
[4] Coal Age. V. 67, No. 12, December 1962, p. 28
[5] Coal Age. V. 67, No. 11, November 1962, p. 125.

TABLE 2.—Coal (bituminous) production, by counties

(Thousand short tons and thousand dollars)

County	1961		1962	
	Quantity	Value	Quantity	Value
Barbour	3,062	$13,401	3,054	$13,190
Boone	5,196	24,119	5,934	26,941
Brooke	523	2,224	734	2,647
Fayette	4,422	20,688	4,796	22,333
Gilmer	1,009	4,527	1,025	4,336
Grant	66	228	83	278
Greenbrier	896	3,358	454	1,954
Harrison	6,391	27,737	6,472	27,175
Kanawha	9,141	39,783	10,584	44,174
Lewis	573	2,007	296	981
Lincoln	33	109	33	73
Logan	14,247	62,952	15,527	67,547
Marion	9,206	49,295	9,150	48,907
Mason	447	1,498	454	1,455
McDowell	12,919	83,086	13,762	88,288
Mercer	847	5,294	959	6,006
Mineral	43	151	52	232
Mingo	5,038	25,150	5,432	26,789
Monongalia	5,982	29,165	(1)	(1)
Nicholas	4,922	23,236	5,768	28,636
Pocahontas	239	900	386	1,407
Preston	2,589	8,729	2,998	11,036
Putnam	81	353	75	371
Raleigh	6,597	35,644	6,321	34,778
Randolph	1,146	5,004	720	2,963
Taylor	201	677	450	1,431
Tucker	194	587	45	143
Upshur	1,178	5,228	1,176	5,071
Wayne	54	249	62	276
Webster	820	3,909	772	3,359
Wyoming	10,354	58,289	10,234	55,599
Undistributed [2]	4,654	20,948	10,691	49,917
Total	113,070	558,525	118,499	578,293

[1] Included with "Undistributed."
[2] Includes data for Braxton, Clay, Marshall, and Ohio Counties, and counties indicated by footnote 1.

TABLE 3.—Coal (bituminous) production

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1953–57 (average)	140,400	$717,596	1960	118,944	$597,222
1958	119,468	635,201	1961	113,070	558,525
1959	119,692	621,003	1962	118,499	578,293

Petroleum and Natural Gas.—Production of petroleum increased 21 percent. Output of natural gas and natural gas liquids remained virtually the same as in 1961.

The number of well completions increased by 189 to 1,309, setting a record for total completions in the State. Among these, 952 were gas wells, 167 were oil wells, 142 were dry holes, and 48 were service wells. Total footage drilled was 3,289,873 feet, an average of 2,513 feet per well. Only 16 of the completions were wildcat wells, but this is twice the number of wildcat wells drilled in 1961. Five wildcat wells were dry holes. Of the field well drilling, most of the successful footage was in gas well completions (2,388,693 feet). Successful oil well footage was 349,876 feet. Of

the 952 gas wells completed, over two-thirds were between 1,250 and 2,500 feet deep. No successful well was drilled deeper than 7,500 feet. Of the 167 oil well completions, over 80 percent were between 1,250 and 2,500 feet deep. No successful oil well was drilled deeper than 5,000 feet. Of total completions, 1,202 were by cable-tool rigs and 107 were by rotary rigs.

Leading counties in development completions for natural gas were Lewis (149), Ritchie (140), Doddridge (113), Gilmer (86), and Kanawha (77) and for petroleum were Doddridge (62), Gilmer (20), Ritchie (16), and Lewis (12).[6]

The much publicized deep well drilling by Phillips Petroleum Co. in Marion County, south of Morgantown, proved to be a failure. After probing 17,111 feet into the earth and producing a few "shows" of limited quantities of natural gas, the large rig was dismantled and moved to near Gladesville in Preston County for another try.[7]

According to the American Petroleum Institute and the American Gas Association, reserves on December 31, 1962 were 2,037,053 million cubic feet of natural gas, 56,172,000 barrels of petroleum, and 58,859,000 barrels of natural gas liquids.

Elk Refining Co. at Falling Rock and Quaker State Oil Refining Corp. at St. Marys operated petroleum refineries performing skimming, cracking, and lubricating oil operations.

NONMETALS

Cement.—Combined shipments of portland and masonry cement were significantly greater than in 1961. Average value per barrel remained virtually unchanged. The major portion of production was the non-air-entrained, general use, and moderate heat type, but significant quantities of air-entrained cement also were produced. Shipments were primarily in bulk and about half the output was shipped by rail and the other half by truck. Ready-mixed concrete and concrete product manufacturers, chiefly in Maryland, Virginia, the District of Columbia, western Pennsylvania, and West Virginia, consumed most of the shipments.

A new cement distribution station with a capacity of 10,000 barrels was placed in operation by Columbia Cement Corp., a subsidiary of Pittsburgh Plate Glass Co., at Nitro.

Clays.—Production of clays continued to decline and fell 6 percent below the tonnage of 1961. Output of fire clay and miscellaneous clay declined by almost the same percentage. Reduced quantities of fire clay were consumed by both the refractory and building brick industries. Less miscellaneous clay production was used for brick and cement manufacture.

Hancock County was the leading clay-producing area, with one open-pit and two underground fire-clay mines. Berkeley County ranked second with three open-pit miscellaneous-clay mines.

Gem Stones.—Miscellaneous specimens were collected by hobbyists at scattered locations throughout the State. Specimens collected in re-

[6] Oil and Gas Journal. V. 61, No. 4, Jan. 28, 1963, pp. 153–228.
[7] Producers Monthly, May 1963, p. 17.

TABLE 4.—Clays sold or used by producers

Year	Fire clay		Miscellaneous Clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1953–57 (average)	440,780	$2,055,881	307,308	$272,636	748,088	$2,328,517
1958	264,107	1,732,634	245,699	227,340	509,806	1,959,974
1959	328,792	2,178,974	266,932	312,970	595,724	2,491,944
1960	346,053	2,328,865	279,570	310,341	625,623	2,639,206
1961	259,340	1,964,265	215,497	228,531	474,837	2,192,796
1962	(1)	(1)	(1)	(1)	446,867	2,085,597

[1] Figure included in total to avoid disclosing individual company confidential data.

cent years included aragonite and stilbite in Hardy County and fossils in Mineral County.

Lime.—For the second successive year, lime production decreased 9 percent. The decreased output of dead-burned dolomite was primarily responsible for the overall decrease. Increased quantities of chemical and agricultural lime were produced, but output of construction lime decreased. Quicklime and hydrated lime were produced at one plant in Berkeley County, but only quicklime was produced in Jefferson County.

Natural Salines.—Production of bromine compounds which was sharply reduced in 1961, was discontinued in 1962. Output of calcium-magnesium chloride decreased significantly in 1962. Well brines from an operation at South Charleston were the only commercial source of the material.

Salt.—Production of salt increased 16 percent. Most of the salt output was consumed in brine for manufacturing chlorine and other chemicals. A small quantity of evaporated salt was sold to feed dealers and feed mixers. Two operations were active in Marshall County, and Kanawha and Mason Counties each had an active operation.

Sand and Gravel.—The sand and gravel industry continued its recovery, increasing production 7 percent over that of 1961. The overall market was improved, and virtually uniform increases were reported for most uses. Building continued to be the leading use, comprising over half of the output. Paving sand and gravel and the specialized market for industrial and ground sand comprised most of the remainder. Glass manufacture was an important market for industrial sand. Of the total output, 64 percent was sand and 36 percent was gravel. Average value per ton increased by $0.02 to $2.10. No production of Government-and-contractor sand and gravel was reported. Production was reported by 25 operations in 16 counties. Hancock County led in production, followed in descending order by Morgan, Wood, Ohio, Tyler, and Brooke Counties. Morgan County, with valuable glass sand deposits, led in value of production. The major portion of the production outside Morgan County was recovered by dredges on the rivers in the State.

Slag (Iron-Blast-Furnace).—Production of slag principally for aggregate continued. The Weirton plant of Standard Slag Co. received a certificate of achievement in safety from the National Slag

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and by uses

Class of operation and use	1961		1962	
	Short tons	Value	Short tons	Value
Commercial operations:				
Sand:				
Building	1,362,004	$1,671,464	1,441,748	$1,834,155
Paving	586,402	846,515	654,527	995,956
Fire or furnace	31,032	35,687	(1)	(1)
Engine	98,353	275,600	(1)	(1)
Undistributed [2]	1,082,834	5,242,251	1,207,236	5,561,910
Total	3,160,625	8,071,517	3,303,511	8,392,621
Gravel:				
Building	1,290,461	1,428,268	1,355,338	1,635,596
Paving	423,870	643,111	492,282	825,688
Railroad ballast	4,738	6,396	(1)	(1)
Fill	1,746	2,297	(1)	(1)
Other	150	225	50,473	88,698
Total	1,720,965	2,080,297	1,898,093	2,549,982
Total sand and gravel	4,881,590	10,151,814	5,201,604	10,942,003

[1] Included with "Undistributed."
[2] Includes fill, glass, molding, blast, other industrial, and ground sands.

Association Safety Competition for working 108,650 man-hours without a disabling work injury.

Stone.—Decreased demand for crushed sandstone and crushed limestone for aggregate in the roadbuilding program of the State was the primary factor in a 2-percent decrease in total stone production. Decreased aggregate production offset a significant increase (over 40 percent) in limestone production for cement manufacture. Crushed-limestone output for flux in the steel industry became steady after a sharp drop in 1961. Production for lime manufacture decreased and output for stone sand increased slightly. Other applications for crushed limestone included agricultural uses, inert dust for coal mines, and asphalt filler. Most of the sandstone output was crushed for roadstone, but a small quantity of dimension sandstone also was produced, chiefly for rough construction and dressed building stone. Stone production was reported from 24 counties, of which the leading were Berkeley, Jefferson, Monongalia, and Greenbrier Counties.

TABLE 6.—Stone sold or used by producers, by uses

Use	1961		1962	
	Short tons	Value	Short tons	Value
Crushed and broken stone:				
Flux	1,479,548	$2,818,445	1,460,279	$2,793,764
Concrete and roadstone	3,918,099	6,359,469	3,469,065	5,815,292
Railroad ballast	500,970	700,285	521,066	726,479
Other [1]	334,628	883,449	352,840	857,934
Dimension sandstone	4,335	64,134	(2)	(2)
Undistributed [3]	1,390,794	2,418,623	1,703,006	3,049,022
Total	7,628,374	13,244,405	7,506,256	13,242,491

[1] Includes limestone for miscellaneous uses (glass, asphalt filler, coal dust, poultry grit 1962, glass sand 1961, stone sand, unspecified 1962).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes limestone for cement and lime, riprap, agriculture; and refractory sandstone.

METALS

Aluminum.—Kaiser Aluminum & Chemical Corp. continued to operate its four-potline primary aluminum plant at Ravenswood.

Ferroalloys.—A wide variety of ferroalloys, chiefly ferromanganese, ferrosilicon, silicomanganese, ferrochromium, and ferrochromium silicon, were produced at Alloy and Graham.

Iron and Steel.—Wheeling Steel Corp. moved into the active construction phases of its $145 million expansion program. Major projects included an 80-inch hot strip mill, a steelmaking plant using the basic oxygen process, and a 60-inch continuous-galvanizing line.[8] The company program to increase pig iron capacity would be completed with the rebuilding of one of its five blast furnaces undertaken late in 1962.[9]

Manganese.—Plans were announced by Manganese Chemicals Corp. to build a manganese ore reduction plant near Kingwood. Basic raw material was to be shipped from Baltimore Md., and plant output would be shipped for consumption by the steel industries in the Pittsburgh, Cleveland, and Chicago areas.[10]

Nickel.—International Nickel Co., Inc., had its first full year of production after the major expansion of its nickel and nickel-alloy tubing plant at Huntington.

Zinc.—Matthiessen & Hegeler Zinc Co. operated a vertical-retort zinc smelter at Meadowbrook.

Zirconium.—Carborundum Metals Co., Inc., produced zirconium sponge from Florida zircon at a plant in Wood County.

REVIEW BY COUNTIES

Barbour.—Bituminous coal production in Barbour County decreased only slightly although the number of mines decreased from 60 to 47. Of the total coal production, 76 percent was mined at 36 underground mines, 20 percent was mined at 8 strip mines, and 4 percent was mined at 3 auger mines. Almost 90 percent of the underground production was mechanically loaded. Eight continuous-mining machines were active; two more than in 1961, because Bethlehem Mines and Badger Coal Co. each added one machine. Four cleaning plants were active, preparing 50 percent of output. Clinchfield Coal Co. closed its Compass No. 3 and Compass D mines in August, idling 85 men, but opened its Compass F mine in April and its Compass G mine in November, employing 115 men.

Feather Construction Corp. increased production of sandstone for road construction at the Barbour F quarry near Belington.

Berkeley.—Standard Lime & Cement Co., Division of Martin Marietta Corp., continued to be the sole producer of portland and masonry cements in the State, operating five of its six kilns at Martinsburg. One kiln was shut down the entire year for repairs. Cement shipments, which were significantly larger than in 1961, went mainly to Maryland, Virginia, the District of Columbia, and Pennsylvania.

[8] American Metal Market. V. 69, No. 249, Dec. 31, 1962, p. 5.
[9] American Metal Market. V. 69, No. 179, Sept. 17, 1962, p. 4.
[10] Washington Post. Mar. 1, 1962, p. D9.

TABLE 7.—Value of mineral production in West Virginia, by counties[1]

County	1961	1962	Minerals produced in 1962 in order of value[2]
Barbour	(3)	(3)	Coal, stone.
Berkeley	[4] $14,487,270	$16,965,533	Cement, stone, lime, clays.
Boone	24,118,922	26,940,646	Coal.
Braxton	(3)	(3)	Coal, stone.
Brooke	2,685,694	3,123,283	Coal, sand and gravel.
Cabell	(3)	(3)	Sand and gravel, clays.
Clay	(3)	(3)	Coal.
Doddridge	(3)	(3)	Stone.
Fayette	20,688,037	22,333,025	Coal.
Gilmer	4,527,082	4,364,155	Coal, stone.
Grant	(3)	(3)	Do.
Greenbrier	(3)	(3)	Do.
Hampshire	140,000	75,000	Stone.
Hancock	(3)	(3)	Sand and gravel, clays.
Hardy	17,924	22,248	Stone.
Harrison	(3)	(3)	Coal, stone.
Jackson	(3)	----	
Jefferson	(3)	(3)	Stone, lime.
Kanawha	41,736,386	46,637,096	Coal, salt, clays, stone, calcium-magnesium chloride.
Lewis	(3)	1,038,580	Coal, stone, clays.
Lincoln	127,056	77,103	Coal, sand and gravel.
Logan	62,951,574	67,546,519	Coal.
McDowell	83,119,958	88,287,617	Do.
Marion	49,295,314	48,906,745	Do.
Marshall	(3)	(3)	Coal, salt.
Mason	(3)	(3)	Coal, salt, sand and gravel.
Mercer	(3)	6,009,669	Coal, clays.
Mineral	(3)	(3)	Coal, stone, sand and gravel.
Mingo	25,149,718	26,789,373	Coal.
Monongalia	[4] 31,237,446	30,100,106	Coal, stone, sand and gravel.
Morgan	(3)	(3)	Sand and gravel.
Nicholas	23,240,194	(3)	Coal, stone.
Ohio	(3)	(3)	Coal, sand and gravel.
Pendleton	(3)	284,672	Stone.
Pleasants	(3)	(3)	Sand and gravel.
Pocahontas	(3)	(3)	Coal, stone.
Preston	(3)	(3)	Do.
Putnam	416,025	370,766	Coal.
Raleigh	(3)	34,794,706	Coal, stone, sand and gravel.
Randolph	(3)	(3)	Coal, stone.
Ritchie	----	86,005	Stone.
Taylor	676,682	(3)	Coal, clays.
Tucker	(3)	273,294	Coal, stone, sand and gravel.
Tyler	(3)	(3)	Sand and gravel.
Upshur	5,328,455	5,115,453	Coal, stone.
Wayne	315,569	282,025	Coal, sand and gravel.
Webster	3,909,351	3,359,448	Coal.
Wetzel	362,781	(3)	Sand and gravel.
Wood	(3)	(3)	Do.
Wyoming	58,355,854	55,599,494	Coal.
Undistributed	[4] 237,362,274	225,581,686	
Total	[4] 690,249,000	714,964,000	

[1] Calhoun, Monroe, Roane, Summers, and Wirt Counties are not listed, because no production was reported.
[2] Excludes natural gas, natural gas liquids, petroleum, some gem stones and stone, and some sand and gravel (1961) not assigned to specific counties, included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Revised figure.

Ready-mixed concrete companies consumed almost two-thirds of the shipments. Concrete product manufacturers, building material dealers, and highway and other contractors consumed the balance.

Increased limestone production raised the county to first place in the State, which had 14 limestone-producing counties. Producers were J. A. Prather (formerly J. E. Baker Co.) of Inwood and Standard Lime & Cement Co., Division of Martin Marietta Corp; Blair Limestone Division, Jones & Laughlin Steel Corp.; and Fry Coal & Stone Co., Division of Martin Marietta Corp (all of Martinsburg). Limestone production was used chiefly for cement and lime manufac-

ture. Other uses included blast-furnace and open-hearth flux, railroad ballast, and concrete aggregate.

Blair Limestone Division, Jones & Laughlin Steel Corp., received a certificate of achievement in Safety for operating its Martinsburg quarry 137,968 man-hours without a disabling work injury.

Increased lime production was reported by Standard Lime & Cement Co., Division of Martin Marietta Corp., and Blair Limestone Division, Jones & Laughlin Steel Corp., both of Martinsburg. Hydrated lime was produced for masonry mortar, and quicklime was produced for agricultural and chemical uses. Two rotary and two shaft kilns were operated during 1962. Miscellaneous clay was mined for building brick and for cement manufacture by The United Clay Products Co. of North Mountain and by Standard Lime & Cement Co., Division of Martin Marietta Corp., and Continental Clay Products Co., both of Martinsburg.

Boone.—Five additional mines were operated, raising the total to 54. Coal production increased 14 percent, and the county ranked eighth among the coal-producing counties. Of total production, 87 percent was mined at 44 underground mines, 5 percent at 1 strip mine, and 8 percent at 9 auger mines. Auger production more than doubled, owing to a large new operation by Foremost Fuels and increased output by Youghiogheny & Ohio Coal Co. Of the total underground production, 94 percent was mechanically loaded by 49 mobile loaders, 16 continuous miners, and 5 face conveyors. Six cleaning plants cleaned 84 percent of output. The Wharton No. 1 mine of Eastern Gas & Fuel Associates closed in May, idling 180 men. Leading coal producers in the county were Westmoreland Coal Co., Eastern Gas & Fuel Associates, Youghiogheny & Ohio Coal Co., and Armco Steel Corp.

Braxton.—The number of active coal mines decreased from five to three, but total county production increased 32 percent. There were no active strip or auger operations in 1962. Guardian Coal Co. operated the Lizanne cleaning plant, using jigs and heavy-medium separation. Almost nine-tenths of the underground output was loaded mechanically by two mobile loaders and three hand-loaded face conveyors.

Crushed sandstone for concrete aggregate was produced by Meadows Stone & Paving Co. at three plants near Gassaway, Sutton, and Webster Springs.

Brooke.—Coal production was 40 percent greater than in 1961. Of the total output, 57 percent was mined at five underground mines, 42 percent at six strip mines, and 1 percent at two auger mines. Of the total underground production, 96 percent was loaded mechanically by four mobile loaders into shuttle cars. The Half Moon cleaning plant and the Beech Bottom plant of Windsor Power House Coal Co. operated cleaning plants using jigs and hydroseparators, respectively. The leading underground producer was Windsor Power House Coal Co., and the leading strip producers were Formis & Formis Coal Co. and Huberta Coal Co., Inc.

Increased sand and gravel production was reported by Duquesne Sand Co., Beech Bottom, which produced sand for building and pav-

ing, and gravel for paving and by Brilliant Sand Co., Follansbee, which produced fire or furnace sand, and gravel for fill.

Cabell.—Decreased sand and gravel production was reported by Ohio River Dredging Co. and Union Sand & Gravel Co., both of Huntington. Output was chiefly for building and paving. Miscellaneous clay (red shale) was mined near Barboursville by Barboursville Clay Manufacturing Co.

Clay.—Coal production at five underground and one auger mine increased 3 percent. Almost all of the underground production was mechanically loaded by 12 mobile loaders and 8 hand-loaded face conveyors. A major portion of the county output was prepared at the Rich Run cleaning plant of Clinchfield Coal Co., using heavy-medium separators. Of the total output, 93 percent was crushed and 34 percent was treated with oil.

Doddridge.—Feather Construction Corp. reported decreased production of crushed sandstone for paving at the Doddridge K plant, West Union.

Fayette.—Coal production increased 8 percent, and the number of active mines increased by 11 to 178. Of the total coal production, 95 percent was mined at 169 underground mines, 3 percent at 3 strip mines, and 2 percent at 6 auger mines. Of the underground production, 74 percent was mechanically loaded by 53 mobile loaders, 15 continuous miners, and 26 hand-loaded face conveyors. Eight cleaning plants were active, preparing 45 percent of the total output. The New River Coal Co. closed its Garden Ground mine and plant and Eel River Mining Co., Inc., closed its strip and auger mines in March. Mary Francis Coal Co. closed its Westerly No. 22 mine in September and Southern Coals Corp. temporarily closed its Cunard No. 2 mine in September. New mines were opened by Ranger Fuel Corp., which started a strip operation in March, and the Mary Frances Coal Co. which opened the Westerly No. 23 mine late in the year. The Royalty Smokeless Coal Co. changed its name to Clifftop Smokeless Coal Co. in October. Leading producers were Semet Solvay Division, Allied Chemical Corp., The New River Co. (two mines), Clifftop Smokeless Coal Co. (two mines), Ranger Fuel Corp., and Milburn Colliery Co. (two mines).

Gilmer.—Coal production increased slightly, and the number of mines increased from 14 to 16. Of total production, 95 percent was mined at 11 underground mines, 1 percent at 2 strip mines, and 4 percent at 3 auger mines. Strip-mined production decreased significantly because of the closing of the R & H Coal Co. mine. Of the total underground production, 90 percent was loaded mechanically by 12 mobile loading machines and 1 continuous miner. The Rochester & Pittsburgh Coal Co. operated the only cleaning plant in the County and cleaned its entire output using jigs.

Sandstone was crushed for paving roads at the Furr plant of Basil R. Heavner, Glenville.

Grant.—A 26 percent increase in coal production was reported, and the number of mines increased from six to eight (seven underground mines and one strip mine). Lindsey Coal Mining Co. operated the one strip mine in the county. Increased limestone production was reported by Beans Lime & Stone Co., Inc., Petersburg, and Keplinger

Lime Co., Maysville. Output was for concrete aggregate and for agricultural stone (agstone).

Greenbrier.—Coal production in Greenbrier County decreased 49 percent, and the number of mines decreased from 78 to 65. Strip production decreased significantly because the Lafayette Springs Coal Co. mine was idle the entire year. Almost nine-tenths of the output was mined at 61 underground mines, the balance was from 3 strip mines and 1 auger mine. Of the underground production, only 18 percent was loaded mechanically by 2 mobile loading machines and 12 hand-loaded face conveyors. Owing to the shut down of the Lafayette Springs Coal Co. cleaning plant, only one plant was active; it was operated by Leckie Smokeless Coal Co. (formerly Anjean Coal Co.) and used heavy-medium separation.

Crushed limestone, mainly for concrete aggregate, was produced by Acme Limestone Co. and H. Frazier Co., Inc., both of Fort Spring. Smaller quantities were used for railroad ballast, agricultural purposes, dust for coal mines, and stone sand.

Hampshire.—Crushed limestone for concrete aggregate was produced by Williams' Quarry, Romney.

Hancock.—Although sand and gravel production decreased 5 percent, the county continued to rank first among the sand and gravel producing counties. Producers were the Dravo Corp.,operating its No. 9 and No. 16 dredges, and the Volino Bros. Arroyo Sand & Gravel Co. stopped operating. Output was used chiefly for building.

Plastic fire clay for firebrick and block, steelworks and foundries, and ladle brick was mined near New Cumberland by Crescent Brick Co., Inc., and West Virginia Fire Clay Manufacturing Co. and by the Globe Brick Co. at Newell. Globe continued its automation program by completing a new grinding room, automatically controlled with one operator watching an electrical console, and taking care of the grinding needs of three plants making refractory products.[11]

Hardy.—The Baker Lime plant of the State Soil Conservation Service, Potomac Valley district, continued to produce crushed limestone for concrete aggregate and agstone.

Harrison.—The number of active coal mines decreased by 7 to 103, but output increased 1 percent; because of this increase the county rose from sixth to seventh place among the State's coal-producing counties. Of total production, 74 percent was mined at 73 underground mines, 21 percent at 23 strip mines, and 5 percent at 7 auger mines. Strip and auger tonnage increased significantly even though there were 13 fewer mines in 1962. This increase was due to a resumption of strip mining by Bitner Fuel Co., which was idle in 1961, and to the opening of an auger mine by the same company. The county was the leading strip-mining area, producing over 1 million tons of strip coal, or 22 percent of the strip output. Of the coal mined underground, 90 percent was mechanically loaded by 51 mobile loading machines (58 percent) and 12 continuous miners (42 percent). Four more continuous miners were used than in 1961. Seven cleaning plants cleaned 55 percent of the county coal output; 45 percent was crushed and 10 percent was treated. Clinchfield Coal Co. announced

[11] Brick and Clay Record. V. 141, No. 3, September 1962, pp. 72, 73.

the opening of the Mars underground mine in April. McCandlish Coal Co. closed its Duncan No. 5 mine in May but opened the Duncan No. 6 mine in August. Clinchfield Coal Co., with three mines, and Mountainer Coal Co., with two mines, were the leading producers.

Northview Stone Co., Clarksburg, and Salerno Bros. Co., Pine Bluff, produced crushed sandstone for concrete aggregate. Feather Construction Corp. abandoned its L quarry. Paul Harrold closed the Shinnston limestone quarry but opened a quarry at Wolf Summit and produced crushed limestone for concrete aggregate.

Jackson.—Anderson's Black Rock Corp. closed its Jackson County quarry and opened a new quarry in Ritchie County.

Jefferson.—Limestone production decreased 16 percent, and the county dropped to second place among the limestone-producing counties. Producers all located at Millville, were Michigan Limestone Division, U.S. Steel Corp.; Blair Limestone Division, Jones & Laughlin Steel Corp.; and Standard Lime & Cement Co., Division of Martin Marietta Corp. Most of the output was used as flux in blast-furnace and open-hearth plants. Other uses included the manufacture of dead-burned dolomite, railroad ballast, and concrete aggregate. Refractory lime was manufactured by Standard Lime & Cement Co., Division of Martin Marietta Corp., at Millville. Blair Limestone Division, Jones & Laughlin Steel Corp., and Michigan Limestone Division, U.S. Steel Corp., received certificates of achievement in safety from the National Safety Competition for operating their Millville quarries 91,036 man-hours and 84,893 man-hours, respectively, without a disabling work injury.

Kanawha.—Coal production increased 16 percent, and the county moved from fifth to third place in coal production in the State. Three more mines were active in 1962. One hundred and twelve underground mines produced 85 percent of the total output, 7 strip mines 3 percent, and 12 auger mines 12 percent. The county led in auger production producing 37 percent of the total auger output and being the only county in the State to produce over 1 million tons of auger coal. Auger production more than doubled; Carbon Fuel Co. and Robbin Coal Co. reported significantly increased output. In addition, North American Coal Corp. opened a large mine in February. Strip production in the county increased sharply. Carbon Fuel Co. and E. M. Frederick & Associates, Inc., reported increased strip-mining activity. In addition, five new strip mines were opened during 1962. Of the underground output, 95 percent was mechanically loaded by 96 mobile loaders (89 percent) and 12 continuous miners (11 percent). The balance was handled by six hand-loaded face conveyors. Nine cleaning plants prepared 70 percent of the total county output; 57 percent was crushed, and 12 percent was treated. New mines opened during 1962 included the Cannelton Coal & Coke Co. No. 10 mine, the North American Coal Corp. new auger and strip mines, the Oglebay-Norton Co. No. 18 mine and the Dorothy No. 4 strip and auger mines, the No. 3 underground mine of Union Carbide Metals Co., Division of Union Carbide Corp., and the Valley Camp Coal Co. VC No. 9 mine. Oglebay-Norton Co. closed its No. 12, 3, and 13 undreground mines in April, May, and September, respectively. Leading producers were The Carbon Fuel Co. (three mines), Oglebay-Norton Co. (nine mines),

Cannelton Coal Co. (three mines), Valley Camp Coal Co. (two mines), Union Carbide Metals Co. (two mines), and Central Appalachian Coal Co. Union Carbide Metals Co. received a certificate of achievement in safety from the National Safety Competition for operating its Bell Creek mine 135,483 man-hours without a disabling work injury.

Inorganic Chemical Division, FMC Corp. (formerly Chlor-Alkali Division) increased production of salt brine for manufacturing chlorine at South Charleston. Calcium-magnesium chloride also was produced by this company, but at a reduced rate. There was no output of bromine or bromine compounds during the year.

Tony Pacifico Co. quarried sandstone near Charleston for refractories and irregularly shaped building stone. Mazzella Quarries, Inc., produced crushed sandstone near Charleston for concrete aggregate. Fire clay for building brick and building tile was mined by Charleston Clay Products Co. and West Virginia Brick Co., both of Charleston.

Lewis.—Coal production decreased 48 percent, and the number of active mines increased from seven to nine. Sharply decreased strip and auger production was noted; Bitner Fuel Co. reduced strip mining and ceased auger production. Keeley Construction Co. operated the only cleaning plant in the county, using jig separation. Eighty-five percent of the output was crushed.

Weston Stone Co., Weston, produced crushed sandstone for concrete aggregate. Feather Construction Corp. closed its Lewis E quarry, significantly decreasing overall sandstone production. Weston-Jane Lew Brick & Tile Co. operated its No. 1 plant at Weston and its No. 2 plant at Jane Lew and produced miscellaneous clay for building brick and tile.

Lincoln.—Four companies dredged coal from the Guyandot River: Campbell Brown Coal & Sand Co., Davis & Adkins Coal and Sand Co., Dial Coal Co., and Ferrellsburg Coal & Sand Co. Production was slightly lower than in 1961.

Production of sand decreased sharply. Engine sand was produced by Dial Coal Co., Branchland. Davis & Adkins Sand Co. and Dean Coal & Sand Co. were idle in 1962.

Logan.—Coal production increased 9 percent, and the county continued to rank first in the State among the coal-producing counties. Seven new mines were active, increasing the number to 69. Of the total production, 97 percent was produced at 59 underground mines, and the balance was produced at 1 strip mine and 9 auger mines. Almost all of the underground production was loaded mechanically. Ninety-three percent was loaded by 138 mobile loading machines and 7 percent by 12 continuous-mining machines (5 more than in 1961). Over nine-tenths of the output was prepared at 19 cleaning plants; 17 percent was crushed, and 19 percent was treated. Mines and plants abandoned during the year included the No. 7 mine and the Elk Creek preparation plant of Island Creek Coal Co., the Ethel mine of Ethel Mines, Inc., the Mellville No. 1 mine and cleaning plant of Jewell Eagle Coal Co., and the Stirrat No. 19 mine of Omar Mining Co. The McGregor No. 1 mine, which was closed by Amherst Coal Co. in 1961, was purchased by E. A. Mining Co. in April 1962. The Jane Ann No. 3 mine, which was closed by Princess Coals, Inc., in 1959, was reopened

in March. The Raleigh Eagle Coal Co. opened a strip mine in February and an auger mine in September. The No. 28 mine of Island Creek Coal Co. was taken over by National Coal Mining Co. in December. Almost two-thirds of county output was produced by four companies. They were Island Creek Coal Co. (four mines), Amherst Coal Co. (five mines), Omar Mining Co. (three mines), and Princess Coals, Inc. (four mines). Production was largely from the Island Creek, Cedar Grove, Powellton, and Chilton coal seams.

Marion.—Only 13 mines were operated (same as 1961), but the county ranked fifth among the State's coal-producing counties. Production decreased less than 1 percent. Almost the entire output was mined at 11 underground mines. There also were two active strip mines. Almost all the underground production was loaded mechanically. Eighty-seven percent was loaded by 52 continuous miners and 13 percent was loaded by 11 mobile loading machines. This was an increase of 3 continuous miners and a decrease of 10 mobile loading machines, compared with 1961. Two additional continuous miners were placed in operation by Eastern Gas & Fuel Associates and one by Bethlehem Minerals Co. Eight cleaning plants cleaned almost all of the county output, and 21 percent of the output was crushed. The leading producers were Mountaineer Coal Co. (three mines), Bethlehem Minerals Co. (two mines), Eastern Gas & Fuel Associates, Joanne Coal Co., and Rochester & Pittsburgh Coal Co. Production was almost entirely from the Pittsburgh coal seam.

Marshall.—Coal production from three underground mines was 7 percent greater than in 1961. Producers were Hanna Coal Co., Valley Camp Coal Co., and the West Virginia State Penitentiary. Almost all the county output was loaded mechanically by 2 mobile loading machines and 15 continuous-mining machines (the same as in 1961). Of the total, 52 percent was cleaned by jigs and chance cones and 73 percent was crushed.

The county continued to rank first among the three salt-producing counties in the State. Output was greater than in 1961. Producers were Chemical Division, Pittsburgh Plate Glass Co., New Martinsville, and Solvay Process Division, Allied Chemical Corp., Moundsville. Output was chiefly for chlorine manufacture.

Mason.—Coal production increased 2 percent, and the number of active mines increased by 2, to 14. Seventy-seven percent of the total output was mined at 10 underground mines, 21 percent at 3 strip mines, and 2 percent at 1 auger mine. Of the underground production, 91 percent was mechanically loaded by eight mobile loading machines and six hand-loaded face conveyors. There was no mechanical cleaning in the county, but 85 percent of the output was crushed.

Liverpool Salt Co., Hartford, produced evaporated salt for sale to feed dealers and mixers, for water softening, and to grocers and meat packers. Sand and gravel, chiefly for building and paving, was produced by Mason Aggregates, Inc., West Columbia, and Letard Sand & Gravel Co., Inc., New Haven.

McDowell.—Coal production increased 6 percent; 29 additional mines were operated, bringing the total to 201 and ranking the county second among the coal-producing counties. Of the total output, 95 percent was mined at 187 underground mines and the balance from 7 strip

and 7 auger mines. Auger mining increased significantly; four new auger mines were opened. Of the total underground production, almost nine-tenths was mechanically loaded. Equipment included 79 continuous-mining machines (6 more than in 1961), 59 mobile loading machines, 15 hand-loaded face conveyors, and 4 duckbills. Twenty preparation plants (three more than in 1961) cleaned 87 percent of the county coal output; 36 percent was crushed, and 42 percent was treated with oil. Production was chiefly from the Pocahontas No. 3 and the Pocahontas No. 4 coal seams. The leading producers, accounting for almost three-fourths of output, were U.S. Steel Corp. (four underground mines, one strip mine, and one auger mine), Island Creek Coal Co. (three underground mines), Eastern Gas & Fuels Associates, Bishop Coal Co., and Olga Coal Co. The United States Steel Corp. closed its No. 9 mine late in the year, and the No. 10 mine was idle for the last half of 1962. U.S. Steel Corp. received certificates of achievement in safety from the National Safety Competition for operating its No. 9 and 10 mines 148,286 man-hours and 149,499 man-hours, respectively, without a disabling work injury.

Mercer.—Coal production increased 13 percent, and the number of active coal mines increased by 11 to 41. Underground production was virtually the same as in 1961, but strip and auger mining activity was greatly accelerated. Seven additional auger mines were operated in 1962, and Pocahontas Fuel Co. opened a large strip operation. Of the total output, 83 percent was mined at 29 underground mines, 16 percent at 4 strip mines, and 1 percent at 8 auger mines. Of the underground production, 88 percent was loaded mechanically by 15 mobile loading machines (an increase of 4) and 1 continuous-mining machine. Three cleaning plants prepared 73 percent of the county output. Arista Mining Co., Inc., purchased and reactivated the Piedmont mine, which was closed by Pocahontas Fuel Co. in 1960.

Miscellaneous clay for building brick and heavy clay products was mined by Virginia Brick & Tile Co., Princeton.

Mingo.—Twelve new mines reported in 1962, increasing county coal output by 8 percent and ranking the county 11th in the State. Of the total output, 96 percent was produced at 91 underground mines and 4 percent was produced at 9 auger mines. Auger mining increased significantly, owing to the opening of the Preservati Coal Co. auger mine. Of the underground production, 95 percent was mechanically loaded by 53 mobile loading machines (an increase of 5) and 8 continuous-mining machines (an increase of 3). Almost nine-tenths of the county output was prepared at eight cleaning plants; 22 percent was crushed, and 16 percent was treated with oil. The leading producers were Island Creek Coal Co., National Mining Co., Crystal Block Coal & Coke Co., and Ames Coal Co. National Mining Co. assumed the operation of the No. 25 mine of Island Creek Coal Co. late in the year.

Mineral.—Coal production increased 20 percent, and the number of mines increased from five to six (five underground and one auger). There was no mechanical loading or mechanical cleaning in the county.

Limestone production increased sharply, owing to the new operation of Fry Coal & Stone Co., Division of Martin Marietta Corp., near Pinto and increased output by Aurora Stone Co., Thomas, and

Spencer Lime Co., Keyser. Output was for concrete aggregate. Sand and gravel was produced for building by the Potomac Sand & Stone Co., Keyser.

Monongalia.—Coal production decreased slightly in 1962, and the number of mines decreased by 14 to 50. The county dropped to ninth place, having been eighth in the State in 1961. Of the total operating mines, 45 were underground, 3 were strip, and 2 were auger. Underground and auger production decreased. Strip production increased significantly, but there were two fewer producers than in 1961. Of the underground production, 98 percent was loaded mechanically by 16 mobile loading machines and 22 continuous-mining machines. Three preparation plants cleaned 64 percent of the county output. This was one plant fewer than in 1961, because the Valley Camp Coal Co. Maiden No. 2 mine and plant closed. Production was almost entirely from the Pittsburgh coal seam.

Limestone production was reported by Greer Limestone Co. and Green Bag Cement Co., Division of Marquette Cement Manufacturing Co., Morgantown. The latter operation was opened in June. Crushed stone from this new high-grade limestone mine was barged down the Monongahela River to the cement plant of Green Bag Cement Co. on Neville Island at Pittsburgh. County output was used chiefly for concrete aggregate and cement manufacture. Smaller quantities were used for railroad ballast, stone sand, agstone, and riprap.

The Deckers Creek Sand Co., Morgantown, produced glass and engine sands.

Morgan.—Glass sand production at the Berkeley works of Pennsylvania Glass Sand Corp. increased slightly. Output was used mainly for glass manufacture. The county ranked first in value and second in production among the sand- and gravel-producing counties.

Nicholas.—Coal production increased 17 percent, and the number of active mines increased by 7 to 116. The county ranked 10th among the State's coal-producing counties. Of the total production, 95 percent was mined at 105 underground mines, 2 percent at 5 strip mines, and 3 percent at 6 auger mines. Of the total underground production, 92 percent was mechanically loaded by 40 mobile loading machines (8 fewer than in 1961) and 36 continuous-mining machines (14 more than in 1961). Eight cleaning plants prepared 71 percent of the total county output; 30 percent was crushed and 11 percent was treated. The Gauley Coal & Coke Co., Donegan Division, abandoned its No. 3H mine in July, idling 109 men. The same company's Saxsewell Division opened a new mine (No. 3) in May, employing 60 men. Leading producers in the county were Gauley Coal & Coke Co., Johnstown Coal & Coke Co., and Imperial Smokeless Coal Co.

Nettie Sand Co., Nettie, produced a small amount of crushed sandstone for concrete aggregate and roadstone.

Ohio.—Coal production at three underground mines decreased slightly. Almost all the county output was mechanically loaded by six mobile loading machines and was cleaned at preparation plants using jigs and tables. Thirty-three percent of the output was crushed, and 67 percent was treated by a combination of calcium chloride and oil.

Sand and gravel production more than doubled. Producers were Delta Concrete Co., Wheeling, and Ohio River Sand & Gravel, Parkersburg. Output was chiefly for building and paving, but a small quantity of gravel was produced for railroad ballast and fill. The county ranked fourth in the State among the sand-and gravel-producing counties.

Pendleton.—Crushed limestone was produced by Germany Valley Limestone Co., Division of Greer Limestone Co., Riverton; North Fork Lime Producers, Riverton; and Ruddle Lime Co., Franklin. Production, which increased significantly, was for concrete aggregate, agricultural use, dust for coal mines, glass manufacture, and poultry grit.

Pleasants.—Decreased output of sand and gravel was reported by Ohio River Sand & Gravel Co., Parkersburg. The output was chiefly for paving. Small quantities were for building, railroad ballast, and fill.

Pocahontas.—Coal production increased 61 percent, mainly because two underground mines were opened by Beckley Division, Cherry River Coal & Coke Co. Strip production more than doubled owing to the increased strip production of Cherry River Coal & Coke Co. Of the underground production, 98 percent was mechanically loaded by four mobile loading machines, five continuous miners, and two hand-loaded face conveyors. There had not been any continuous mining in 1961. Gauley Coal & Coke Co. closed its Donegan No. 8 mine in September, idling 80 men.

Terra Alta Limestone Co. produced crushed limestone at Marlinton for concrete aggregate.

Preston.—Coal production increased 16 percent, owing principally to increased underground mining activity. Both strip and auger production decreased. Of the total output, 74 percent was mined at 86 underground mines and the balance at 19 strip mines and 2 auger mines. Even though strip mining decreased by 15 percent, the county was the second largest strip-mining area in the State. Equipment at the strip mines included 34 power shovels, 2 drag lines, 23 bulldozers, 3 horizontal and 3 vertical drills, and 52 trucks, averaging 17 tons in capacity. Of the underground production, 42 percent was mechanically loaded by 12 mobile loading machines (an increase of 5), 2 continuous-mining machines (none in 1961), and 16 hand-loaded face conveyors. Chapel Coal Co. began continuous mining with two machines loading onto conveyors. Of the total output, 27 percent was cleaned at three preparation plants, and 28 percent was crushed.

Terra Alta Limestone Co. resumed operations in 1962 and produced large quantities of crushed limestone at Aurora. Prestone Limestone Co., Inc., continued operating at Kingwood. Output was chiefly for concrete aggregate. Brookside Stone Co. produced dimension sandstone near Brookside for sale as cut stone, flagging, and irregularly-shaped stone.

Putnam.—Coal production decreased 8 percent. Only 11 mines (half as many as in 1961) were active (10 underground and 1 strip). The entire production was loaded by hand. There was no mechanical cleaning, but one-third of the output was crushed.

Raleigh.—Coal production decreased 4 percent, and the county dropped from sixth to seventh place among the coal-producing coun-

ties. Of the total production, 96 percent was produced at 107 underground mines, 4 percent at 6 strip mines, and less than 1 percent at 5 auger mines. Underground and auger production decreased, but strip production increased, because of the opening of the Sprague No. 3 mine by Winding Gulf Coals, Inc., in January. Auger production decreased, chiefly because Carbon Fuel Co. closed its auger operation early in 1962. Of the total underground production, 81 percent was mechanically loaded by 59 mobile loading machines (5 fewer than in 1961), 20 continuous miners (2 more than in 1961) and 31 hand-loaded face conveyors (18 fewer than in 1961). Fifteen cleaning plants prepared 74 percent of the county output. New preparation plants were opened by Winding Gulf Coals and Raleigh Empire Coal Co. The Lillybrook plant closed in 1961. Armco Steel Corp. abandoned its No. 5 mine in May. Over two-thirds of the county coal production was mined by four companies. They were Winding Gulf Coals, Inc., Slab Fork Coal Co., Armco Steel Corp., and Eastern Gas & Fuels Associates.

Building sand was produced by Beaver Block Co., Beaver. The Table Rock sand plant crushed sandstone for concrete aggregate and roadstone near Beckley.

Randolph.—The number of active mines increased by 5 to 37. Coal production decreased by 37 percent. Of the total production, 93 percent was mined at 30 underground mines, 6 percent at 5 strip mines, and 1 percent at 2 auger mines. Both underground and strip mine tonnage decreased significantly, but two auger mines were opened. No auger mines had been operated in 1961. Of the total production, 80 percent was mechanically loaded by 6 mobile loading machines (6 fewer than in 1961), 14 continuous miners (1 more than in 1961), and 16 hand-loaded face conveyors. There was no mechanical cleaning in the county, but 39 percent of the output was crushed and 5 percent was treated with oil. Peerless Coals, Inc., closed its Birch mine and opened a new mine (No. 3) in July. Bethlehem Mines Corp. sold its Golding Ridge No. 92 mine to Grafton Coal Co. in February.

Elkins Limestone Co., Elkins, and Sam G. Polino, Bowden, produced crushed limestone, mainly for concrete aggregate. Smaller quantities were sold for railroad ballast. The Elkins Limestone Co. received a certificate of achievement in safety from the National Safety Competition for its 48,663 man-hours worked without a disabling work injury.

Ritchie.—Anderson Black Rock, Inc., produced crushed sandstone near Washburn for concrete aggregate.

Taylor.—Coal production more than doubled in Taylor County, and the number of mines increased from 18 to 24. Both underground and strip mining increased, but the increase in strip production was greater, because of a new operation of Thompson Coal & Construction Co. Twenty-one underground mines and three strip mines were active. There was no mechanical cleaning in the county, and only a small amount of the underground production was mechanically loaded by one mobile loading machine.

Shale for building brick was mined by Grafton Brick Co., Grafton.

Tucker.—Coal production decreased significantly, because two large strip mines in the county shut down. Two underground mines and

one strip mine remained active. There was no mechanical loading or cleaning.

Fairfax Sand & Stone Co. produced sand for building and paving. Elkins Asphalt Co., Quarry Division, produced crushed limestone for concrete aggregate near Nestorville.

Tyler.—Ohio River Sand & Gravel, Parkersburg, produced increased quantities of sand and gravel primarily for paving. Smaller quantities were used for building, railroad ballast, and fill.

Upshur.—Coal production remained virtually the same as in 1961, and one less mine was active. Twenty-two underground mines and five strip mines were operated. Of the underground production, 90 percent was mechanically loaded by 10 mobile loading machines (1 less than in 1961) and 4 continuous-mining machines. Four cleaning plants prepared 69 percent of the county output; 68 percent was crushed, and 11 percent was treated.

Basil R. Heavner produced crushed sandstone for concrete aggregate near Buckhannon.

Wayne.—Coal production from four small hand-loading underground operations increased 15 percent. There was no mechanical loading or cleaning in the county.

Preston Sand & Gravel Co., Inc., Fort Gay, produced sand for building and for use in mines.

Webster.—Coal production decreased 6 percent. The number of active mines increased by 6 to 39 (37 underground and 2 strip). Of the total underground production, 66 percent was mechanically loaded by 8 mobile loading machines, 8 continuous-mining machines, and 5 hand-loaded face conveyors (12 less than in 1961). Three cleaning plants prepared 54 percent of the output. This was an addition of one cleaning plant; Sugar Creek Corp. opened a new underground mine and preparation plant using dense-medium and air separation. Of the total output, 24 percent was crushed and 15 percent was treated. The Bergoo Corp. abandoned its No. 4 mine at the end of the year idling 87 men.

Wetzel.—Increased sand and gravel production was reported, because of a new operation by Ohio River Sand & Gravel, Parkersburg, and increased output by Ohio Valley Sand Co., New Martinsville. Output was used for building, paving, railroad ballast, and fill.

Wood.—Increased sand and gravel production was reported. The pit of Pfaff & Smith Builders Supply Co., Charleston, was reopened. Other producers were Kanawha Sand Co. and Ohio River Sand & Gravel, both of Parkersburg. Output was used chiefly for building, paving, and railroad ballast.

Wyoming.—Seven new coal mines were reported active. Production decreased 1 percent and the county dropped from third to fourth place. Underground production remained virtually the same, but strip production decreased sharply, because of decreased output by operating mines and the abandonment of the Phillips Coal Co. Reedy strip mine. Of the total output, 99 percent was mined at 65 underground mines, and the balance at 5 strip mines and 3 auger mines. Of the total underground production, 94 percent was loaded by 92 loading machines (10 fewer than in 1961), 39 continuous-mining machines (1 more than in 1961), and 10 hand-loaded face conveyors.

Twelve duckbills used in 1961 were inactive in 1962. Fourteen cleaning plants prepared 82 percent of the county output; 23 percent was crushed, and 16 percent was treated with oil. The Marianna No. 8 mine of Island Creek Coal Co. was closed in June. The five leading producers accounting for more than two-thirds of the total county output were Eastern Gas & Fuel Associates, Pocahontas Fuel Co., Island Creek Coal Co., Semet Solvay Division, Allied Chemical Corp., and Crozer Coal & Land Co.

The Mineral Industry of Wisconsin

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Wisconsin for collecting information on all minerals except fuels.

By Wesley A. Grosh [1]

MINERAL output in Wisconsin was valued at $68.3 million in 1962, a 7-percent decrease from that of 1961, and the lowest recorded value since 1956. Nonmetals represented 83 percent of the value of minerals produced in the State, compared with 82 percent in 1961. The value of metals decreased 10 percent and nonmetals, 7 percent.

TABLE 1.—Mineral production in Wisconsin [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Abrasive stones: Grinding pebbles, and tube-mill liners (1961)—short tons	560	$17	569	$17
Clays—thousand short tons	126	130	137	156
Iron ore (usable)—thousand long tons, gross weight	1,122	(2)	1,045	(2)
Lead (recoverable content of ores, etc.)—short tons	680	140	1,394	256
Sand and gravel—thousand short tons	39,978	28,457	33,649	24,408
Stone—do	13,418	19,686	13,392	19,709
Zinc (recoverable content of ores, etc.)—short tons	13,865	3,189	13,292	3,057
Value of items that cannot be disclosed: Cement, gem stones, lime, peat, and values indicated by footnote 2	----------	[3] 21,892	----------	20,686
Total	----------	[3] 73,511	----------	68,289

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Revised figure.

Consumption, Trade, and Markets.—Sand and gravel production decreased in 1962. One of the principal factors in this decrease was a substantial reduction in use by the State highway department. Value of clay production increased 20 percent. Stone production, including abrasives, showed little change from the previous year. Cement and lime production also remained approximately the same as 1961.

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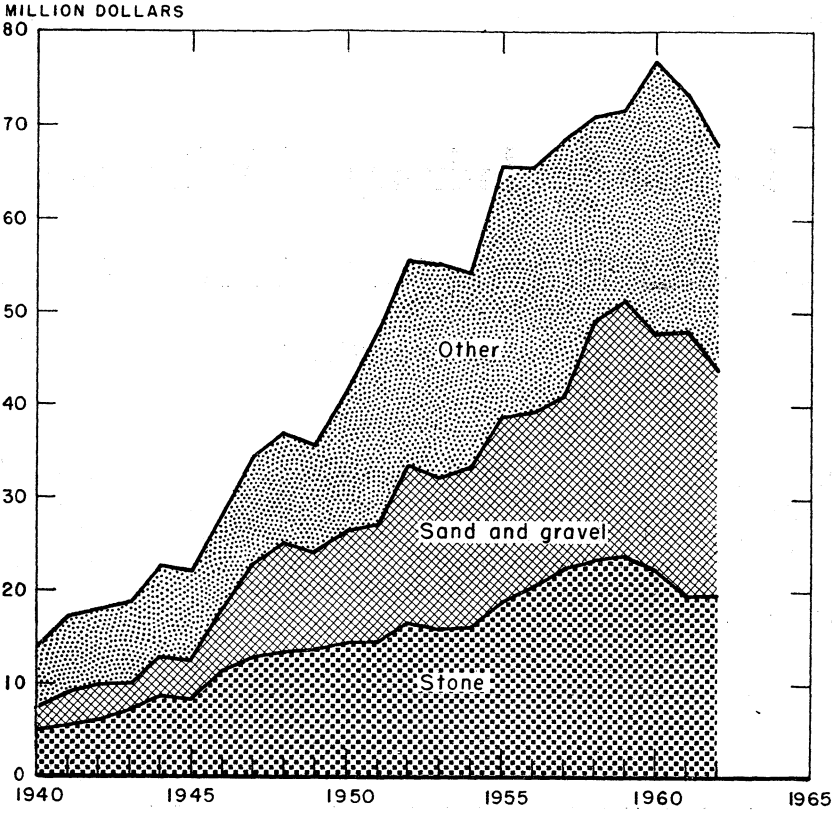

FIGURE 1.—Value of sand and gravel, stone, and total value of all minerals produced in Wisconsin, 1940–62.

Peat production increased significantly in quantity and value. The lower prices for lead and zinc for most of the year were reflected in a lack of interest in exploration and expansion of capacity, and were responsible for the closing of at least one mine. Preference of steelmakers for high-grade premium structural iron ores made the sale of direct-shipping ores more difficult and resulted in the closing of one of the two producing iron mines in the State in August.

Trends and Developments.—Exploration activity for iron ores in the Black River Falls area was reported. The trend towards high-grade ore products will continue to be felt by direct-shipping ore producers, and therefore a continued search for deposits suitable for producing high-grade products is expected. The New Jersey Zinc Co. deferred plans for exploitation of their lead-zinc ore body near Elmo due to low metal prices.

Employment and Injuries.—Over 8.6 million man-hours were worked in Wisconsin mineral industries in 1962, excluding officeworkers. This represented a 15-percent decrease from the 10.1 million man-hours recorded for 1961. Declines in the iron ore, limestone, and

sand and gravel industries were chiefly responsible for the overall drop.

Six fatalities, two at sand and gravel plants and one each at cement, coke oven, iron ore, and limestone operations, occurred in 1962, compared with seven in 1961. Total number of nonfatal disabling injuries decreased to 254 (preliminary figure), compared with the final figure of 332 for 1961.

Table 2 contains a summary of employment and injury data for selected State mineral industries. Certain industries are excluded from the table, primarily to avoid disclosing individual company confidential data.

TABLE 2.—Employment and injuries for selected mineral industries [1]

Year and industry	Average number of men working	Total man hours	Total number of disabling injuries		Total number of days lost or charged	Injury frequency rate [2]	Injury severity rate [3]
			Fatal	Nonfatal			
1961:							
Granite	118	237,850	1	10	(4)	46.24	(4)
Limekiln [5]	117	282,805	-------	12	(4)	42.43	(4)
Limestone [6]	1,197	2,040,844	-------	100	(4)	49.00	(4)
Sand and gravel	2,747	4,363,691	1	68	8,110	15.81	1,859
Sandstone	106	190,890	-------	9	(4)	47.15	(4)
1962: [7]							
Granite	116	227,226	-------	10	370	44.01	1,628
Limekiln [5]	114	277,147	-------	15	193	54.12	696
Limestone [6]	1,063	1,546,883	1	47	7,131	31.03	4,610
Sand and gravel	2,421	3,706,800	2	65	13,420	18.07	3,620
Sandstone	67	96,297	-------	2	67	20.77	696

[1] Excludes officeworkers.
[2] Total number of injuries per million man-hours.
[3] Total number of days lost or charged per million man-hours.
[4] Data not available.
[5] Includes quarries producing limestone used in manufacturing lime.
[6] Excludes quarries producing limestone used in manufacturing cement and lime.
[7] Preliminary figures.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Baraboo Quartzite Co. produced milled pebbles for polishing and deburring from a quartzite deposit in Sauk County. Production and value of pebbles remained approximately the same as in 1961. Competition from low-cost pebbles imported from Europe and with artificial abrasives manufactured in the United States continued.

Cement.—Production and shipments of portland and masonry cements from the two plants in Wisconsin decreased slightly from that of 1961 in both quantity and value. Demand for portland and masonry cements in Wisconsin was met partly by the importation of over 5.5 million barrels from plants in the States of Illinois, Indiana, Iowa, Minnesota, and Michigan, although some cement was shipped from Wisconsin plants to Michigan and Minnesota.

The types of portland cement produced in the State were general use and moderate heat, and high early strength. Production capac-

ity of the two producing plants in Wisconsin remained approximately the same as in 1961. No change was made in the number and size of kilns in operation. The average mill value per 376-pound barrel of portland cement was $3.44 compared with $3.40 in 1961.

Manitowoc Portland Cement Co., subsidiary of Medusa Portland Cement Co., manufactured cement at Manitowoc by the wet process, using limestone from Michigan and clay obtained locally. The company operated four kilns.

Marquette Cement Mfg. Co. produced portland and masonry cements at Milwaukee by the dry process, using limestone from Michigan and shale from Illinois. One kiln was operated.

Universal Atlas Cement Division, United States Steel Corp. shipped clinker from its plant in Indiana to a grinding plant in Milwaukee. Huron Portland Cement Co. continued operation of its storage silos at Milwaukee and at Green Bay for cement made in a Michigan plant.

Most of the cement produced in the State was shipped in bulk and by truck. Truck shipments showed an increase of almost 6 percent, whereas rail shipments showed a decline of more than 22 percent. Shipments of cement to building material dealers, concrete product manufacturers, and highway contractors decreased while shipments to ready-mixed concrete companies and other contractors increased.

Clays.—Miscellaneous clay or shale was produced in Wisconsin by eight companies, one more than in 1961. Quantity increased almost 9 percent, and value increased 20 percent. The value of clay produced is an approximate mining cost. Most of the clay mined was used by the producing company in manufactured products. One company sold clay. Products made from clay, in descending order or quantities used, were cement, building brick, and heavy clay products. Production of clay for manufacturing cement decreased slightly from 1961, but production for other uses increased. Counties where clay was produced were Brown, Dunn, Fond du Lac, Manitowoc, Racine, Sauk, and Waupaca.

Lime.—Production of lime increased about 6 percent in quantity and 4 percent in value. Data for regenerated lime produced by paper mills have been excluded from total State value of mineral production in 1962. Producers reporting quicklime for use only in their own plants were Mayville White Lime Works at Mayville and the Thilmany Pulp and Paper Co. at Kaukauna. The Mosinee Paper Mills at Mosinee installed a lime recovery system which reduced the amount of new lime used for processing a ton of pulp by 90 percent. Cutler-LaLiberte-McDougall Corp. started construction at their Superior plant for installation of a large, more efficient dust collection system. Value of total sales increased 4 percent over sales in 1961. Seventy-three percent of the lime production was quicklime. Principal uses of lime produced in decreasing order of quantities was for paper manufacture; water purification; metallurgy; insecticides, fungicides, and disinfectants; sewage; metal polishing; plastics manufacturing; tanning; brick; and fertilizer manufacturing.

Companies producing lime for sale were The Western Lime & Cement Co., with plants in Brown, Dodge, and Fond du Lac Counties, Cutler-LaLiberte-McDougall Corp. in Douglas County, and the Rockwell Lime Co. in Manitowoc County.

Perlite.—Crude perlite produced in Nevada and New Mexico was expanded in plants of Western Mineral Products Co. at Milwaukee and Midwest Perlite Co. at Appleton. Expanded perlite was used mostly as a lightweight concrete aggregate. Use of expanded perlite as an aggregate decreased, but its use in building plaster increased. Total quantity decreased 16, and value decreased 14 percent from 1961.

Sand and Gravel.—Total production of sand and gravel decreased 16 percent in quantity and 14 percent in value. Quantity and value of commercial sand and gravel remained approximately the same as in 1961, but production from Government-and-contractor operations decreased 36 percent in quantity and 40 percent in value. A substantial reduction in quantity reported by the State highway commission accounted for the greatest reduction. Sand and/or gravel was produced in 63 of the 71 counties; however, several operators did not indicate the source of all their production.

The substantial increase in molding sand production was mostly due to a reclassification of material reported in other categories in previous years. All other commercial sand production showed a decrease, except fill sand which increased 13 percent in quantity and 25 percent in value. Gravel for building and railroad ballast decreased in quantity and value but increased for paving use. Other production of sand was for glass, hydrofractionating, blast, engine, filtration, foundry, and cement pipe.

The 10 leading producers of sand and gravel in Wisconsin, in alphabetical order were Courtney & Plummer, Inc., Neenah; W. R. Dubois & Son, Inc., Baraboo; Janesville Sand & Gravel Co., Janesville; William J. Kennedy & Son, Inc., Janesville; Edward Kraemer & Sons, Inc., Plain; Manley Sand Division, Rockton, Ill.; Lyle T. Manley Co., Rockton, Ill.; Arthur Overgaard, Inc., Elroy; Plautz Brothers, Inc., Willard; Rein, Schultz & Dahl, Inc., Madison.

Of the commercial sand and gravel production, 91 percent was transported by truck, 7 percent by railroad, and 2 percent by waterway. Eighty-nine percent of the commercial sand and gravel was processed and had an average value of $0.83 per ton, the 11 percent of unprocessed material had an average value of $0.49 per ton. Ninety-eight percent of the sand and gravel produced by Government agencies was processed with an average value of $0.56 per ton, and the unprocessed sand and gravel was valued at $0.33 per ton. Sand and gravel produced by contractors under contract for Government units was 67 percent processed and valued at $0.70 per ton as compared to the unprocessed material at $0.45 per ton.

Stone.—Little change occurred in total quantity or value of stone produced. Stone production included limestone, sandstone, basalt, gran-

ite, marble, quartzite, and marl. Dimension stone production decreased 13 percent in quantity and 8 percent in value, and crushed stone production decreased less than 1 percent in quantity and increased less than 2 percent in value. Dimension limestone production decreased 16 percent in quantity and 5 percent in value and crushed limestone increased slightly in quantity and value with all limestone production showing a slight increase in quantity with a slight decrease in value.

Production of dimension stone in descending order of value was limestone, granite, and sandstone. All dimension stone production decreased in value from 1961 as follows: limestone, 5 percent; granite, 10 percent; and sandstone, 25 percent. There were 23 producers

TABLE 3.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand: [1]				
Molding	106	$266	560	$1,544
Building	3,378	2,852	3,022	2,418
Paving	2,814	2,054	1,888	1,525
Railroad ballast	102	81	[2]	[2]
Fill	874	451	985	564
Undistributed [3]	282	303	208	550
Total	7,556	6,007	[4] 6,662	[4] 6,600
Gravel:				
Building	3,570	3,184	3,124	2,636
Paving	9,401	6,836	11,482	7,936
Railroad ballast	415	291	303	151
Fill	608	346	691	332
Other	946	801	214	178
Total	14,940	11,458	15,814	11,233
Total sand and gravel	22,496	17,465	22,476	17,833
Government-and-contractor operations:				
Sand:				
Paving	5,401	2,762	2,685	1,414
Fill	481	184	421	147
Undistributed [5]	34	18	76	33
Total	5,916	2,964	3,182	1,594
Gravel:				
Building			400	211
Paving	11,311	7,913	7,211	4,608
Fill	249	111	379	162
Other	6	4		
Total	11,566	8,028	[4] 7,991	4,981
Total sand and gravel	17,482	10,992	11,173	6,575
All operations:				
Sand	13,472	8,971	9,844	8,194
Gravel	26,506	19,486	23,805	16,214
Grand total	39,978	28,457	33,649	24,408

[1] Includes friable sandstone.
[2] Included with "Undistributed" to avoid disclosing individual company confidential data.
[3] Includes sand for other uses, engine, blast, filter, oil (hydrafrac), and other industrial sands (1961–62), glass and foundry sand (1962).
[4] Data do not add to totals shown because of rounding.
[5] Includes sand for other uses (1961–62), building sand (1962).

of dimension limestone, 8 producers of dimension granite, and 6 producers of dimension sandstone.

Crushed limestone production was reported from 32 counties, mostly in the southern half of the State. A 3-month strike of independent truckdrivers in the southeastern part of the State affected production adversely.

Crushed basalt, granite, sandstone,and marble also were produced. The basalt was produced in Marathon County by the Ruberoid Co. of New York for roofing granules and from Polk County by Bryan Dresser Trap Rock, Inc., for concrete aggregate. Most of the granite produced was used for monuments and architectural purposes although some was used for road surfacing. Sandstone was largely used for building construction, both as rough shapes and finished. Minnesota Mining & Manufacturing Co. produced roofing granules from an argillite quarry in Marathon County. A marble deposit in Bayfield County produced marble chips for use in manufacturing terrazzo. In order of use, by quantity, for sandstone and quartzite rock other than as dimension stone was railroad ballast, roofing granules, concrete and roadstone, refractories, abrasives, and riprap.

Vermiculite.—Western Mineral Products Co., Milwaukee, also exfoliated crude vermiculite from Montana in their Milwaukee plant. Exfoliated mica was used chiefly for loose fill insulation, plaster aggregate, fireproofing, and acoustical purposes.

TABLE 4.—Limestone sold or used by producers, by uses[1]

Use	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Dimension:				
Rough construction, thousand short tons	12	$95	12	$95
Rubble, do.	23	91	15	86
Rough architectural, thousand cubic feet	5	9	7	13
Dressed (cut and sawed), do.	479	1,167	475	1,151
Flagging, do.	108	102	52	51
Total, thousand short tons[2]	83	1,464	70	1,396
Crushed and broken:				
Riprap, thousand short tons	143	118	60	75
Concrete aggregate and roadstone, do.	9,895	9,960	10,173	10,212
Agriculture, do.	1,322	1,837	1,365	1,792
Lime, do.	84	93	87	78
Other[3], do.	135	190	63	87
Total, do.	11,579	12,198	[4] 11,749	12,244
Grand total, do.	11,662	13,662	[4] 11,818	[4] 13,641

[1] Includes both commercial and Government-and-contractor production.
[2] Average weight of 160 pounds per cubic foot used to convert cubic feet to short tons.
[3] Includes limestone for paper mills (1961), flux, asphalt, fertilizer, filter beds, and other uses.
[4] Data do not add to totals shown because of rounding.

METALS

Iron ore.—Production and shipments of iron ore came from two underground mines on the Gogebic Range in Iron County, the Montreal

mine, operated by Oglebay Norton Co. and the Cary mine, operated by Pickands Mather & Co. All ore was direct-shipping grade. Of the 1,045,000 tons shipped, more than 543,000 tons was shipped through the port of Escanaba, Mich., more than 501,000 tons was shipped through the port of Ashland, Wis., and 245 tons was shipped by rail. The lake shipments, 52 percent from Escanaba and 48 percent from Ashland, compared with 18 percent via Escanaba and 82 percent via Ashland in 1961. Average iron content, natural, of Wisconsin iron ore shipped was 54.24 percent.

Production of iron ore declined 4 percent, and shipments declined 7 percent from 1961. The Cary mine operated throughout the year, two shifts per day, 4 days per week. The Montreal mine operated two shifts per day, 5 days per week until August 10, when the mine was closed permanently and allowed to flood. Inability of the company to sell their direct-shipping ore in competition with higher grade and better structured ores available on the present market necessitated closing the mine. This mine, in operation since 1886, has shipped over 45 million tons of iron ore from its underground operation.

TABLE 5.—Iron-ore production and shipments

Year	Number of mines	Production (thousand long tons)	Shipments (thousand long tons)	Iron content of shipments natural (percent)
1958	2	1,152	867	53.72
1959	4	944	701	53.39
1960	4	1,484	1,502	53.50
1961	2	1,129	1,122	53.61
1962	2	1,081	1,045	54.24

Shipments from the port of Ashland, Wis., began May 9 and ceased November 9. At Escanaba, Mich., the lake shipping season extended from April 17 to November 25.

The Oliver Iron Mining Division of United States Steel Corp. reduced the prices of natural blast furnace iron ores 80 cents per ton and eliminated the Bessemer grade premium beginning April 1, 1962, which resulted in a downward adjustment of Lake Superior iron ore prices. Prices per long ton under the new schedule, based on 51.50 percent natural iron for delivery at rail of vessel, lower Lake ports, were as follows: High Phosphorus, $10.65; Mesabi Non-Bessemer, $10.65; Mesabi Bessemer, $10.80; Old Range Non-Bessemer, $10.90; and Old Range Bessemer, $11.05. The portion of these prices reflecting the shipping costs from mines to lower Lake ports are not included in the total value of iron ore output of Wisconsin. Variations in grade from this base and differences in physical structure from established norms call for premiums or penalties.

Renewed interest in the Black River Falls district was evidenced by the leasing of substantial areas for mineral prospecting in Jackson County. Two companies which are reported to be actively interested are Oliver Iron Mining Division of United States Steel Corp. and Jackson County Iron Co., a subsidiary of Inland Steel Company.

Lead and Zinc.—Production of lead increased 105 percent in quantity and 83 percent in value, but zinc production decreased 4 percent in quantity and value.

The Mining and Smelting Division of Eagle Picher Co. operated the Shullsburg mill throughout the year. The mine and mill are about 2½ miles south of Shullsburg. The mine is operated from a vertical shaft with the headframe adjacent to the mill. Ore from the Birkett-Bastian-Andrews mine and the O'Rourke mine was shipped to the Graham mill of Eagle Picher in Illinois for concentration.

The American Zinc, Lead & Smelting Co., Vinegar Hill Zinc Division, operated the Blackstone-Hancock-Winskell and the Thompson-Temperly mines—all ore being treated in the Vinegar Hill mill, about 3½ miles south of Shullsburg. The mill was shut down the first 2 months of the year for repairs.

Piquette Mining and Milling Co. operated the first 4 months of the year, then closed the mine. Ore was concentrated at a mill on the property.

The Burnham mine near Platteville in Grant County and the Linden mine of Eagle Picher at Linden in Iowa County were idle throughout the year.

Average yearly weighted prices used to calculate values of lead and zinc in table 1 were 9.2 cents per pound for lead and 11.5 cents per pound for zinc as compared with 10.3 cents for lead and 11.5 cents for zinc in 1961.

TABLE 6.—Mine production of lead and zinc, in terms of recoverable metals

Year	Mines producing		Material treated		Lead		Zinc		Total value
	Lode	Tailings	Ore (short tons)	Tailings (short tons)	Short tons	Value	Short tons	Value	
1953–57 (average)	15	5	636,345	49,435	1,957	$565,759	19,231	$4,657,140	$5,222,899
1958	2	------	468,822	----------	800	187,200	12,140	2,476,560	2,663,760
1959	6	------	464,390	----------	745	171,350	11,635	2,676,050	2,847,400
1960	8	1	686,085	993	1,165	272,610	18,410	4,749,780	5,022,390
1961	9	1	465,407	99	680	140,080	13,865	3,188,950	3,329,030
1962	9	------	411,820	----------	1,394	256,496	13,292	3,057,160	3,313,656

TABLE 7.—Mine production of lead and zinc in 1962, by months, in terms of recoverable metals

(Short tons)

Month	Lead	Zinc	Month	Lead	Zinc
January	35	485	August	140	1,265
February	65	645	September	140	1,045
March	145	1,840	October	120	1,155
April	175	1,425	November	65	1,005
May	155	1,195	December	64	1,007
June	150	1,145			
July	140	1,080	Total	1,394	13,292

MINERAL FUELS

Peat.—Although classed as a mineral fuel, peat in Wisconsin was sold mostly for soil improvement. Production increased 45 percent in quantity and 42 percent in value from 1961. Two companies in Waukesha County made shipments in bulk and bagged.

REVIEW BY COUNTIES

Mineral production was reported from each of the 71 counties in the State. Total value of production increased in 39 counties and decreased in 32 counties. Sixteen counties had mineral production valued over $1 million. Sand and gravel production was reported in 63 counties and stone production in 45 counties. Table 8 shows minerals produced in each county since all counties are not discussed in the text.

Adams.—Arthur Overgaard Co. produced sand and gravel for building and paving from a stationary plant near Jackson.

Ashland.—Cold Spring Granite Co., Cold Spring, Minn., produced architectural granite from a quarry near Mellen.

Bayfield.—U.S. Aggregate Co. mined a dolomitic marble deposit near Grandview. A crushed product, marble chips, was produced for use in manufacture of terrazzo.

Brown.—Sand and gravel was produced by seven operators—Daanen & Janssen, Alvin Destree Sand & Gravel, Fred Kropp Sand & Gravel, Schuster Construction Co., W. B. Sheedy Construction Co., Soletski Sand & Gravel Co., and Vic Zeman. Daanen & Janssen also produced limestone. Scray Quarries produced architectural stone. Clay for building brick was produced by Duck Creek Brick Co. and Hockers Brothers Brick & Tile Co. from pits near Green Bay. Lime was produced and sold by The Western Lime & Cement Co. Menominee Sugar Co. reported no production of lime.

Buffalo.—Limestone for riprap, road use, and agriculture was produced by J. Allan Wiles, Mon-Arc Quarries, Inc., and Herbert Tiffany, Jr., from quarries near Cochrane, Mondovi, and Nelson, respectively. The county highway department produced sand for paving and fill.

Calumet.—Sand and gravel was produced for building, paving, and fill by Arnold M. Ortlepp near Potter; Quality Sand & Gravel Co. near Brillion; and Sell Brothers Stone & Gravel Co. near Stockbridge. The county highway commission produced crushed limestone and gravel for road construction.

Chippewa.—Chippewa Sand & Gravel Co. had a stationary plant near Chippewa Falls producing sand and gravel for building. Edward Kraemer & Sons, Inc., operated portable plants for paving gravel near Stanley and Cadott.

Clark.—Sand and gravel was produced from stationary plants by Charles Marek & Son and Carl Opelt Sand & Gravel near Neillsville. Plautz Bros., Inc., and the county highway department produced sand and gravel with portable plants. Ellis Quarries, Inc., did not operate in the county during the year.

TABLE 8.—Value of mineral production in Wisconsin, by counties

County	1961	1962	Minerals produced in 1962 in order of value
Adams	(1)	(1)	Sand and gravel.
Ashland		(1)	Stone.
Barron	$248,075	(1)	Sand and gravel.
Bayfield	(1)	(1)	Stone.
Brown	1,012,072	$967,329	Sand and gravel, lime, stone, clays.
Buffalo	285,478	391,759	Stone, sand and gravel.
Burnett	185,400	78,175	Sand and gravel.
Calumet	241,731	262,433	Sand and gravel, stone.
Chippewa	15,400	(1)	Sand and gravel.
Clark	534,607	(1)	Do.
Columbia	1,622,714	(1)	Sand and gravel, stone.
Crawford	210,178	188,214	Stone, sand and gravel.
Dane	1,678,330	2,014,740	Sand and gravel, stone
Dodge	1,061,513	1,175,149	Sand and gravel, lime, stone.
Door	268,130	331,457	Sand and gravel, stone.
Douglas	(1)	(1)	Lime, sand and gravel.
Dunn	(1)	(1)	Stone, clays.
Eau Claire	(1)	(1)	Sand and gravel.
Florence		25,000	Do.
Fond du Lac	1,351,711	1,522,613	Stone, sand and gravel, lime, clays.
Forest	70,049	63,665	Sand and gravel.
Grant	760,577	680,632	Stone, zinc, sand and gravel, lead.
Green	345,137	364,862	Stone, sand and gravel.
Green Lake	289,411	378,001	Sand and gravel.
Iowa	292,572	448,868	Stone.
Iron	(1)	(1)	Iron ore.
Jackson	(1)	(1)	Sand and gravel.
Jefferson	199,077	301,760	Sand and gravel, stone.
Juneau	(1)	(1)	Stone, sand and gravel.
Kenosha	90,920	300,783	Sand and gravel.
Kewaunee	294,870	289,426	Do.
La Crosse	(1)	239,861	Stone, sand and gravel.
Lafayette	(1)	(1)	Zinc, lead, stone.
Langlade	174,800	188,555	Sand and gravel.
Lincoln	145,052	127,240	Do.
Manitowoc	(1)	(1)	Cement, sand and gravel, stone, lime, clays.
Marathon	[2] 2,734,812	2,029,726	Stone, sand and gravel.
Marinette	(1)	(1)	Do.
Marquette	279,758	219,850	Do.
Milwaukee	(1)	(1)	Cement, stone, sand and gravel.
Monroe	103,030	94,846	Stone.
Oconto	161,427	108,993	Sand and gravel.
Oneida	221,757	206,418	Sand and gravel, stone.
Outagamie	[2] 437,500	557,571	Stone, sand and gravel.
Ozaukee	283,474	386,131	Sand and gravel.
Pepin	1,053	4,543	Do.
Pierce	223,871	236,824	Do.
Polk	311,619	339,773	Stone, sand and gravel.
Portage	340,057	406,545	Sand and gravel, stone.
Price	19,630	10,393	Sand and gravel.
Racine	1,296,558	1,319,348	Stone, sand and gravel, clays.
Richland	(1)	(1)	Stone, sand and gravel.
Rock	1,448,051	1,823,585	Sand and gravel, stone.
Rusk	(1)	58,169	Stone, sand and gravel.
St. Croix	605,867	449,716	Sand and gravel, stone.
Sauk	1,641,218	1,315,288	Stone, sand and gravel, clays, abrasives.
Sawyer	76,691	63,364	Sand and gravel.
Shawano	286,833	205,049	Sand and gravel, stone.
Sheboygan	524,414	232,736	Do.
Taylor	(1)	421,386	Sand and gravel.
Trempealeau	(1)	(1)	Stone.
Vernon	460,913	(1)	Stone, sand and gravel.
Vilas	43,536	169,070	Sand and gravel.
Walworth	496,538	401,880	Do.
Washburn	(1)	(1)	Do.
Washington	1,177,241	615,760	Sand and gravel, stone.
Waukesha	5,986,939	4,849,366	Sand and gravel, stone, peat.
Waupaca	(1)	(1)	Sand and gravel, stone, clays.
Waushara	79,179	(1)	Stone, sand and gravel.
Winnebago	2,147,832	1,681,908	Do.
Wood	(1)	(1)	Do.
Undistributed [3]	40,743,398	39,740,240	
Total	[2] 73,511,000	68,289,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Revised figure.
[3] Includes some sand and gravel and stone that cannot be assigned to specific counties and values indicated by footnote 1.

Columbia.—Manley Sand Division, Martin-Marietta Corp., produced paving, glass, and molding sand near Portage. Other producers of sand and gravel were Wisconsin Dells Sand & Gravel Co. at Wisconsin Dells and Columbia Ready Mix Co. at Pardeeville. Dann & Wendt, Edward Kraemer & Sons, Inc., and the county highway department produced crushed limestone.

Crawford.—Crushed limestone was produced by Loren J. Slaght from four quarries with portable plants at Prairie du Chien, Ferryville, Gays Mills, and Eastman. Velmer Monroe, Croft Lime & Gravel, and Edward Kraemer & Sons, Inc., operated plants at Steuben, Prairie du Chien, and Gays Mills. Stationary sand and gravel plants were operated by Lakeside Sand & Gravel and Prairie Sand & Gravel at Prairie du Chien. The county highway commission obtained sand and gravel by contract and operated its own portable plant.

Dane.—A 20-percent increase in county mineral production was due to an $80,000 increase in sand and gravel production. Seventeen companies and the county highway department accounted for the production. Ten companies operated portable plants and seven companies operated stationary plants. The five leading producers were Capitol Sand & Gravel Co., Hartland-Verona Gravel Co., Madison Sand & Gravel Co., Rein, Schultz & Dahl, Inc., and Stewart Watson Construction Co. Most of the sand and gravel was used for construction purposes. Limestone production was down 15 percent from that of 1961. Most of the production was crushed limestone for construction or agricultural purposes. Eleven companies operated portable plants and one company operated a stationary plant.

Dodge.—Quicklime and hydrated lime were produced at Mayville by Mayville White Lime Works and The Western Lime & Cement Co. Both companies also produced and sold crushed limestone for construction and agricultural lime. Sand and gravel was produced from portable plants by Edward Kraemer & Sons, Inc., near Fox Lake; Linck-Henes Construction Co., Inc., near Beaver Dam; and C. C. Linck, Inc. The county highway department operated a stationary sand and gravel plant. Sandstone was produced by Edward Kraemer & Sons, Inc., near Fox Lake.

Door.—Adamski-Fisher Quarry produced limestone in the form of sawed slabs, house veneer, and flagstone near Sturgeon Bay. The county highway department produced crushed limestone and gravel for paving. Hubert Charles, Vernon E. Olsen Excavating Co., and Howard Serrahn produced sand and gravel.

Douglas.—Cutler-LaLiberte-McDougall Corp. produced quicklime at their plant near Superior. The company started construction on a new dust collection system. Sand and gravel was produced from portable plants by Otto Wiesner, Inc., the City of Superior, and the county highway department.

Dunn.—Menomonie Brick Co. produced clay for manufacture of brick. Edward Kraemer & Sons, Inc., operated a portable plant, producing crushed limestone.

Florence.—The county highway department operated a portable sand and gravel plant producing road material.

Fond du Lac.—The Western Lime & Cement Co. produced quicklime and hydrated lime, as well as crushed limestone, near Eden. Oak-

field Shale Brick & Tile Co. manufactured brick from clay produced in its own pit. Crushed limestone for concrete, paving, and agricultural purposes was produced by seven companies—two using portable plants and five using stationary plants. Companies producing crushed stone were Fond du Lac Stone Co.; C. C. Linck, Inc.; Nellis Limestone Quarry, Inc.; Waupun Ready-Mix Concrete Corp.; Edward Kraemer & Sons, Inc.; and Hamilton Stone Co. Dimension stone, including flagstone, veneer, cut stone irregular shapes, and rubble, were produced by E. Dais Stone Co., Fond du Lac Stone Co., and Hamilton Stone Co.

Using portable plants sand and gravel was produced by Braun Construction Co., Inc.; Koepke Sand and Gravel Co.; C. C. Linch, Inc.; and Cyril H. Simon. Lake View Sand & Gravel Co. operated a stationary sand and gravel plant. The county highway department produced a substantial quantity of sand and gravel with portable plants.

Forest.—Geiter Construction produced sand and gravel for building and paving from a stationary plant. The county highway department operated a portable plant for road gravel.

Grant.—Piquette Mining Co. operated the first 4 months of the year producing lead and zinc concentrates in their mill near Potosi. The mine was closed because of low metal prices. Some jig tailings were sold for road surfacing. Joseph Grimes did not operate during the year. Crushed and agricultural limestone was produced by Becker & Tuckwood from quarries at Lancaster; Croft Lime & Gravel, at Fennimore and Mt. Hope; Dell Needham, at Fennimore; Loren J. Slaght, at Bloomington, Bagley, and Patch Grove; Leonard Staskal & Son, who improved its plant at Boscobel; George Wendtlandt, at Platteville, Cuba City, and Fennimore; and G. A. Watson, at Kieler. Bertie & Russell, a partnership, sold its Zenz quarry to Loren J. Slaght of Prairie du Chien. E. C. Schroeder Co. did not operate either the Chicago-Burlington & Quincy Railroad quarry or the Schroeder quarry. Sand and gravel was produced by Becker & Tuckwood and Dubuque Sand and Gravel Co.

Green.—P. W. Ryan Sons, Inc., operated 12 limestone quarries in the county. Bergen Rock & Lime Co., Rees Construction Co., and Ted Stauffacher operated limestone quarries using portable plants. Sand and gravel was produced from portable plants by Henry Altman, W. J. Kennedy & Son, Inc., and the county highway commission. Lyle T. Manley Co. produced foundry sand near Brownstown.

Green Lake.—Molding sand was produced by Chier St. Marie Sand Co. near Berlin and Clifford Chier Sand Co. near Green Lake. Kopplin & Kines Co., Inc., Paul Polenska & Son, and the county highway commission produced sand and gravel.

Iowa.—Crushed limestone for construction, roads, and agricultural lime was the only mineral production in the county. George Wendtlandt operated 11 quarries; Davis & Richardson, 2 quarries; Croft Lime & Gravel, 2 quarries; Ivey Construction Co., 1 quarry; and G. A. Watson, 1 quarry.

Iron.—Two underground mines—the Cary operated by Pickands Mather & Co. and the Montreal mine operated by Oglebay Norton

Co.—produced all the iron ore from Wisconsin. This county is first in value of mineral production in the State.

The Montreal mine was closed permanently August 10, 1962, and allowed to flood because it was no longer competitive in the iron ore market. This mine which had shipped ore every year, except 1921, since 1886 was for many years the largest underground iron ore mine in the Lake Superior region. During the life of the mine, more than 45 million tons of ore was shipped and it had a production of more than 1 million tons in 13 of its 77 years of operation. It was one of the deeper iron mines and its lowest working level was more than 4,000 feet vertically below the surface. According to the mine management, several million tons of ore, which can no longer be marketed, remains in the mine. At the time the mine closed, 600 men were employed. The loss of this operation seriously affected economic conditions in the county.

The Cary mine operated 4 days a week. Operations were affected by a 1-month strike on the Chicago & Northwestern Railway.

Jackson.—H. T. Smith produced building and paving sand and gravel from a stationary plant and Laurence Murphy produced road gravel from a portable plant. The Oliver Iron Mining Division of United States Steel Corp. and Jackson Iron Co., a subsidiary of Inland Steel Co., were granted mining permits by the Jackson County Board.

The Oliver Iron Mining Division permit covers several thousand acres in the county and the Jackson Iron Co. permit covers 13,000 acres. Both permits are for a 3-year period. Both companies held additional leases on private land.

Jefferson.—Hausz Brothers, Inc., produced crushed and agricultural limestone in a portable plant. Sand and gravel was processed in portable plants by Arne Evensen Sand & Gravel Co., William J. Kennedy & Son, Inc., Rude Sand & Gravel Co., and the county highway commission. Mann Bros. Sand & Gravel, Inc., operated a stationary plant producing gravel for paving.

Juneau.—Arthur Overgaard Co. operated a stationary plant near Mauston and produced limestone for riprap, construction, and agricultural use. The county highway commission produced and contracted for sand and gravel.

Kenosha.—Sand and gravel was the only mineral output in the county, and was used mostly in paving. Portable plants were operated by Bloss Sand & Gravel, William J. Kennedy & Son, Inc., Edward Kraemer & Sons, Inc., and the city of Kenosha. A stationary plant was operated by the county highway department.

Kewaunee.—Stationary sand and gravel plants were operated by Krueger Construction Co., Inc., near Algoma and Schuster Construction Co. near Casco. The county highway department operated a portable sand and gravel plant. All production was used in building or paving.

La Crosse.—Arthur Overgaard, Inc., operated a portable limestone crushing plant near Midway producing crushed stone and agricultural lime. Sand and gravel was produced by Kammel-Smith Sand & Gravel Co. with a portable plant near La Crosse, and the La Crosse Sand and Gravel, Inc., operated a stationary plant near La

Crosse. The county highway department also produced sand and gravel. Tri County Lime Co. discontinued all operations.

Lafayette.—The American Zinc, Lead & Smelting Co. mined lead-zinc ores from the Blackstone, Hancock, and Winskell properties, which was hoisted through a vertical shaft on the Blackstone property south of Shullsburg. The company also mined lead-zinc ore from the Temperly and Thompson properties through an incline near New Diggings. Ore from both mines was hauled by truck to the company's Vinegar Hill mill, about ¼ mile north of the Blackstone shaft. The operations were closed down the first two months of the year while repairs were being made in the mill. Two churn drills were operated on exploration work. The Eagle Picher Co. mined lead-zinc ores at their Shullsburg mine about 3½ miles south of Shullsburg. All ore was hoisted through a vertical shaft and treated in their mill adjacent to the shaft. Lead-zinc ores were also mined from the Birkett-Bastian-Andrews mine, near Hazel Green, through an incline and hauled by truck to the company's Graham mill, north of Galena, Ill. The New Jersey Zinc Co. continued underground development of their ore deposit. Plans for construction of a mill were deferred due to low metal prices. The company continued to operate two churn drills in exploration work.

Crushed limestone was produced from seven quarries near Argyle, Belmont, Darlington, and Blanchardville by Geo. Wendtlandt. G. A. Watson produced crushed limestone from six quarries. Huggins & Son, Otto Jean, and Leo H. Klein produced agricultural lime.

Langlade.—Duffek Sand & Gravel, Inc., produced gravel for building, paving, and fill from a stationary plant near Antigo. The county highway department operated a portable plant for road gravel.

Lincoln.—Merrill Gravel & Construction Co. produced sand and gravel for building, paving, and fill from a stationary plant near Merrill. The county highway department operated a portable sand and gravel plant.

Manitowoc.—Manitowac Portland Cement Co. produced types I and II, general use and moderate heat portland cement, using local clay and limestone shipped by boat from Michigan. Four kilns were operated. Most of the cement was shipped in bulk by truck. Rockwell Lime Co. operated a stationary crushing plant northwest of Manitowoc and shipped crushed stone for concrete, paving, and agricultural use. Some stone was sold for riprap and lime production. Valders Lime & Stone Co. sold dimension stone both rough and sawed, veneer and flagstone, as well as crushed limestone. The city of Manitowoc also produced crushed limestone for paving. Sand and gravel was produced by August Ehnert & Son near Kiel; Everson Bros. near Valders; R & J Fricke Co. near Manitowoc; Kasper Construction Co. near Manitowoc; C. C. Linch, Inc.; Fred Radandt Sons near Manitowoc; Norman Schema near Valders; and Schroeder Bros. Sand & Gravel Co. near Kiel. The city of Manitowoc produced sand and gravel from a stationary plant and the county highway department produced from a portable plant. Rockwell Lime Co. produced quicklime for chemical use and hydrated lime for construction purposes.

Marathon.—More than 88,000 cubic feet of dimension granite, valued at more than $1,077,000, constituting 82 percent of the value of dimension granite in the State, was produced in Marathon County. Most of the production came from an area north of Wausau. The leading producers were Anderson Bros. & Johnson Co., Cold Spring Granite Co., Lake Wausau Granite Co., Prehn Granite Quarries Inc., and Wisconsin Quarries, Inc. Tony Schilling Granite Pit produced crushed granite for concrete and paving. Sand and gravel was produced by Frank Drewek, Heiser Ready Mix Co., Lotz Sand & Gravel Co., and Riverside Gravel Co. Minnesota Mining & Manufacturing Co. operated two quarries near Wausau—one for the production of roofing granules and the other for abrasives. Ellis Quarries, Inc., produced irregular shaped stones and rubble from a sandstone quarry near Mosinee. Marshfield Brick & Tile Co. was idle during 1962.

Marinette.—The Ruberoid Co. of New York purchased the roofing granule division of Central Commercial Co., including their quarry east of Pembine. The new management continued to operate the property and produced roofing granules. Dimension granite for monuments was produced by Anderson Bros. & Johnson Co. near Athelstane and Midwest Granite Co. near Amberg. Sand and gravel was produced by Mason Sand & Trucking with a portable plant near Marinette and by Soo Line Railroad Co. from a stationary plant east of Pembine.

Marquette.—Granite was quarried for monuments by Montello Granite Co. near Montello. Crushed limestone was produced by Edward Kraemer & Sons, Inc., and the county highway department produced road gravel.

Milwaukee.—Portland and masonry cements were produced by Marquette Cement Manufacturing Co. at a plant in Milwaukee using limestone from Michigan and shale from Illinois. Most of the cement produced was shipped in bulk by truck. One kiln was operated making cement by the dry process. Crushed limestone was produced in stationary plants by the Consumers Company, Division of Vulcan Materials Company, near Hales Corners and Franklin Stone Products, Inc., near Franklin. Three companies operated portable plants and three operated stationary plants producing sand and gravel. Western Mineral Products Co. at Milwaukee expanded perlite for building plaster and concrete aggregate, and expanded vermiculite for loose fill insulation, plaster, fireproofing, and acoustical purposes. Raw materials were shipped in from outside the State.

Monroe.—Crushed limestone was produced by Edward Kraemer & Sons, Inc., Schendel Brothers, and Schultz Quarry Co. Mayville White Lime Works of Mayville erected a bulk storage plant near Sparta.

Oneida.—Koepke Sand & Gravel Co., Pitlick & Wick, and Sampson Cranberry Marsh operated portable sand and gravel plants. Musson Bros., Inc., operated a stationary plant. The city of Rhinelander produced sand and gravel and crushed limestone. The county highway department produced sand and gravel.

Outagamie.—At Appleton, Black Creek Limestone Co. and Landwehr, Inc., produced crushed limestone in portable plants. Portable sand and gravel plants were operated by Fox Valley Construction Co. and Landwehr, Inc. Midwest Perlite Co. at Appleton expanded perlite for building plaster from materials shipped into the State.

Ozaukee.—Sand and gravel was produced for building and paving in stationary plants by Cedarburg Sand & Gravel Co., H. O. Muehlberg, Rowe Sand & Gravel, Inc., and Richard Weber, Inc. H. O. Muehlberg, Ozaukee Sand & Gravel Co., and the county highway department also operated portable plants.

Pierce.—Blast and hydrofraction sands were produced by Maiden Rock Silica Sand Co. and the Bay City Sand Co., Inc., which also produced molding, engine, and filter sands. Funk Bros. Transfer, River Falls Sand & Gravel Co., and Rush River Sand & Gravel Co. produced building and paving gravel.

Polk.—Bryan Dresser Traprock, Inc., produced crushed stone for building and paving. Sand and gravel was produced in portable plants by Jorgenson Construction Co., Edward Kraemer & Sons, Inc., Osterman Sand & Gravel, Inc., and the county highway department; and in stationary plants by Bohn Sand & Gravel and Atlas Gravel & Concrete Product Co., formerly known as Horsmann Block & Tile Co. Agricultural limestone was produced by the Polk County Agricultural Agent.

Portage.—Sand and gravel for building and paving was produced by Edward Kraemer & Sons, Inc., F. F. Mengel Co., Wimme Sand & Gravel, and the county highway department. Crushed limestone was produced by Edward Kraemer & Sons, Inc. Ellis Quarries, Inc., produced riprap from a sandstone deposit. Marl for agricultural purposes was produced by the Caldwell's Dredging Co. and Bert Somers.

Racine.—Consumers Company, Division of Vulcan Materials Company, operated a stationary limestone crushing plant near Racine. Producers of sand and gravel were Hillside Sand Co., Inc., near Racine; Edward Kraemer & Sons, Inc., near Burlington, Morrow & Reesman east of Racine, J. W. Peters & Sons, Inc., near Burlington, and the county highway department. Union Grove Drain Tile Co. produced clay for their own use.

Richland.—Crushed limestone was produced by Edward Kraemer & Sons, Inc., and Davis & Richardson. Bock Bros. Sand & Gravel produced sand and gravel.

Rock.—Crushed limestone was produced in a stationary plant near Footville. Portable limestone crushing plants were operated near Beloit, Milton, Clinton, Janesville, and Evansville. Portable sand and gravel plants were operated near Janesville, Edgerton, and Beloit. Stationary sand and gravel plants were operated near Beloit, Edgerton, and Hanover. Janesville Sand & Gravel Co. produced more than 20 different types and sizes of products. Improvement in the plant in the last 10 years has doubled the capacity and more than doubled the tons per man-hour produced.[2] The company ships

[2] Rock Products. In Southern Wisconsin Modernization Wins Market Battle. September 1962, pp. 74–75.

much of its products by rail into the Chicago and Madison areas. The company ships by rail to a ready-mixed concrete plant in Madison—the Four Lakes Fuel & Supply Co., a subsidiary.[3]

St. Croix.—Crushed limestone was produced from portable plants by two companies and the county highway department. The St. Croix Valley Stone Co. reported their quarry was exhausted. Two companies and the county highway department produced sand and gravel for building and paving.

Sauk.—Foley Bros., Inc., produced railroad ballast from a quartzite deposit near Rock Springs. General Refractories Co. and Harbison-Walker Refractories Co., produced crushed quartzite for silica brick. Alfred Boyles Flagstone Quarry produced quartzite flagstone. Baraboo Quartzite Co., Inc., produced grinding pebbles. Four companies produced crushed limestone and three produced sand and gravel. Edward Kraemer & Sons, Inc., produced clay for building brick near Loganville. W. W. Deppe and Matoshek Bros. did not operate in 1962. Holtz & Schulenburg Lime Works bought out Craig Seaman.

Shawano.—Sand and gravel was produced from stationary plants near Bonduel and southwest of Shawano and from portable plants near Cecil and Wescott. The highway department produced crushed stone and sand and gravel for paving.

Sheboygan.—Schroeder Bros. Sand & Gravel Co. produced sand and gravel with a portable plant near Greenbush. Stationary sand and gravel plants were used by Cascade Sand & Gravel Co. near Waldo; Elkhart-Moraine Sand & Gravel Co. near Glenbeulah; and Crystal Lake Crushed Stone Co. near Sheboygan. The latter company reports 67 percent increase in production rate and over 200 percent increase in tons per man-hour over the last 10 years as a result of modernization.[4] Crushed limestone was produced by the Sheboygan County Agricultural Department for building, paving, and agricultural purposes.

Taylor.—Sand and gravel for building and paving was produced in portable plants by Francis Melvin, James Peterson Sons, Inc., Wilbur Storm Construction Co., Zentner Bros. & Haenel, and the county highway department.

Trempealeau.—Crushed limestone was produced near Arcadia by Mon-Arc Quarries, Inc. and Clarence Weiss. Output was for road construction, agricultural use, and riprap. Mon-Arc Quarries, Inc. acquired the Arcadia quarry formerly operated by Neuheisel Lime Works.

Vernon.—Ellefson Bros., Edward Kraemer & Sons, Inc., and Otto Novy produced crushed limestone for concrete, paving, and agricultural lime. The county highway department operated a portable sand and gravel plant.

Walworth.—Sand and gravel was the only mineral production in the county. Leading producers operating portable plants were B. R. Amon & Sons near Elkhorn, Lake Geneva Sand & Gravel Co., Mann

[3] Rock Products. Industry News—Wisconsin Gravel Plant. December 1961, p. 70.
[4] Rock Products. In Eastern Wisconsin Only One Unit Left Over. September 1962, pp. 70–71.

Bros. Sand and Gravel, Inc.; R. W. Miller & Sons, Inc., near Lake Geneva, and Thorpe & Madison near Delavan.

Washington.—Principal sand and gravel producers were John B. Jacklin & Sons operating a portable plant near Richfield, Northern Sand & Gravel Co. operating a stationary plant near West Bend, Ozaukee Sand & Gravel Co. operating stationary plants near Colgate and Germantown, and West Bend Sand & Stone operating a stationary plant near West Bend. The county highway department produced crushed stone and sand and gravel.

Waukesha.—Value of dimension limestone in the county was $1,396,000 and constituted 57 percent of the value of dimension stone produced in the State. Production of limestone in architectural shapes was 357,000 cubic feet, or 67 percent of the State total. Most of the production came from the area around Lannon. Sand and gravel was produced by 29 companies and the county highway department. Leading producers of sand and gravel were Consumers Company, Division of Vulcan Materials Company, Hartland Sand & Gravel Co., Hillview Sand & Gravel Co., T. Johnson & Sons, and Valley Sand & Gravel Co. Humus peat was produced by Demilco, Inc., from a deposit near Wales and sold in bulk and packages. Moss peat in bulk was sold by H. Geipl's Carstom Soil, Inc., from a deposit near New Berlin. A strike by teamsters affected shipment of mineral products in the county.

Waupaca.—Sand, gravel, and crushed stone were produced by C. H. Peters Construction and the county highway department. Merlin Stilen acquired the plant formerly operated by H. G. Dieck Sand and Gravel and produced sand and gravel. Hockers Brick Co. produced clay for building brick. Caldwell's Dredging Co. did not operate as they were moving equipment to a new marl pit. Mayville White Lime Works erected a bulk storage plant at Waupaca.

Winnebago.—Badger Highways Co., Inc., produced riprap, crushed stone, and asphalt filler from a limestone quarry near Menasha. Consumers Company, Division of Vulcan Materials Company, and Courtney & Plummer, Inc., also produced crushed limestone. Sand and gravel was produced in stationary plants by Courtney & Plummer, Inc., F. B. Dubberstein & Sons, Inc., and Schulz Sand & Gravel, Inc. Friedrich, Loots & Below, Inc., produced sand and gravel from a portable plant.

Wood.—Dimension sandstone was produced near Rudolph by Ellis Quarries, Inc., Klesmith Stone Co., and Tony Schmick. The county highway department produced crushed granite and sand and gravel for paving.

The Mineral Industry of Wyoming

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Wyoming for collecting information on all minerals except fuels.

By F. D. Everett [1]

MINERAL OUTPUT in Wyoming increased for the 13th consecutive year, reaching an alltime high of $486 million and representing a 4-percent increase over that of 1961.

Fuels provided $410.3 million or 84 percent of the State total value of minerals produced, nonmetals $42.9 million or 9 percent, and metals $32.6 million or 7 percent.

TABLE 1.—Mineral production in Wyoming [1]

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Beryllium concentrate—short tons, gross weight	2	$1	1	(2)
Clays—thousand short tons	[3] 859	[3] 10,301	1,141	$11,138
Coal (bituminous)—do	2,529	8,573	2,569	8,198
Copper (recoverable content of ores, etc.)—short tons	1	1		
Gem stones	(4)	83	(4)	85
Gold (recoverable content of ores, etc.)—troy ounces	1	(2)		
Iron ore (usable)—thousand long tons, gross weight	(5)	(5)	739	6,441
Mica (sheet)—pounds	27	(2)		
Natural gas—million cubic feet	194,674	24,334	204,996	29,929
Natural gas liquids:				
LP gases—thousand gallons	132,831	5,451	149,438	5,762
Natural gasoline—do	76,349	4,705	78,780	4,935
Petroleum (crude)—thousand 42-gallon barrels	141,937	354,843	[6] 145,167	[6] 361,466
Pumice—thousand short tons	20	20	42	41
Sand and gravel—do	6,669	5,356	7,769	8,104
Silver (recoverable content of ores, etc.)—troy ounces	7	(2)		
Stone—thousand short tons	2,594	3,315	1,755	3,054
Uranium ore—short tons	1,521,064	28,218	1,301,784	25,715
Vanadium—do	(5)	(5)	(5)	442
Vermiculite—do	30	(2)	(5)	(5)
Value of items that cannot be disclosed: Cement, clays (fire clay and miscellaneous clay—1961), gypsum, lime, phosphate rock, sodium carbonate, sodium sulfate, and values indicated by footnote 5		21,046		20,467
Total		[7] 466,247		485,777

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Less than $500.
[3] Excludes fire clay and miscellaneous clay; included with "Value of items that cannot be disclosed."
[4] Weight not recorded.
[5] Figure withheld to avoid disclosing individual company confidential data.
[6] Preliminary figure.
[7] Revised figure.

[1] Mining engineer, Bureau of Mines, Salt Lake City, Utah.

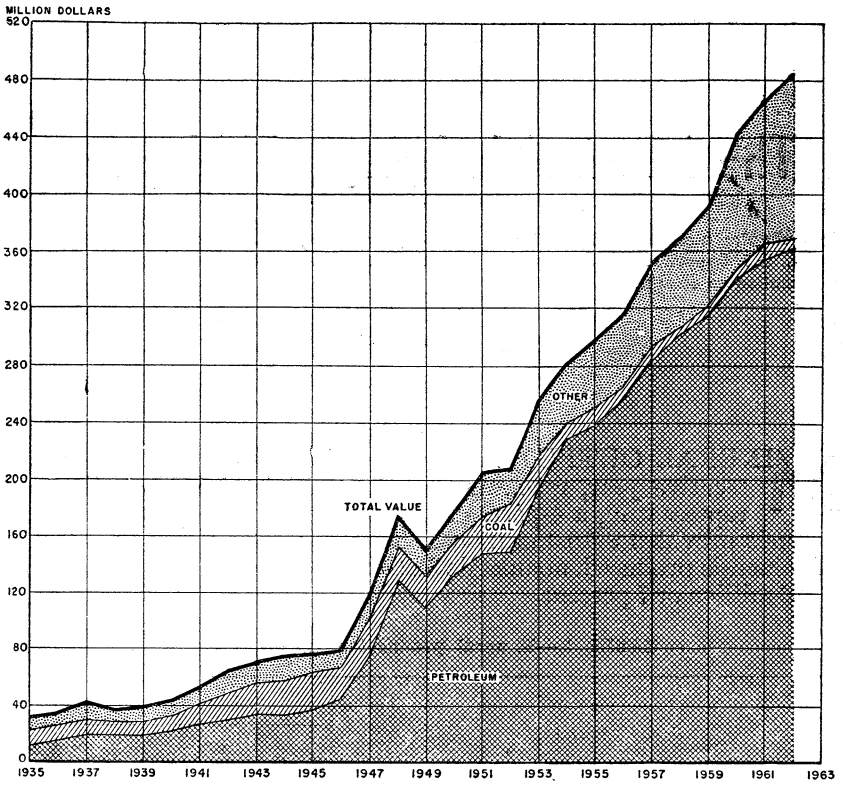

FIGURE 1.—Value of petroleum, coal, and other minerals, and total value of all minerals produced in Wyoming, 1935–62.

Increases in value over those in 1961 were reported for cement, clays, gem stones, gypsum, iron ore, natural gas, natural gas liquids, petroleum, phosphate rock, pumice, sand and gravel, trona (sodium carbonate), vanadium, and vermiculite. Decreases were noted for coal, sodium sulfate, stone, and uranium. No production of copper, gold, silver, or mica was reported in 1962.

Major mineral-industry developments included completion of the Atlantic City iron ore project of the Columbia-Geneva Steel Division, United States Steel Corp.; completion of the soda ash project near Green River by Stauffer Chemical Co. of Wyoming; and completion by Petrotomics Co. of the sixth uranium mill in the State.

Employment and Injuries.—Statistics of employment and injuries for 1961 and preliminary data for 1962 in the mineral industries, excluding all mineral fuels except coal, are given in table 2.

Government Programs.—The Laramie Petroleum Research Center of the Federal Bureau of Mines investigated properties of Green River oil shale, susceptibility of oil sands to water damage in the Powder and

TABLE 2.—Employment and injuries in the mineral industries[1]

Industry	Number of operations	Average number of men employed	Total man-hours worked	Injuries		Frequency rate (injuries per million man-hours)
				Fatal	Nonfatal	
1961:						
Coal mines	20	499	619,233	1	9	16.1
Nonmetal mines and mills (other than sand and gravel and stone)	65	865	1,689,004		27	16.0
Sand and gravel plants	86	574	795,147		5	6.3
Stone quarries and plants	39	442	827,287		20	24.2
Ferrous and nonferrous mines and mills (excluding uranium)	14	415	569,518		23	40.4
Uranium mines and mills	84	1,229	2,542,409		76	29.9
Total	308	4,024	7,042,598	1	160	22.9
1962:[2]						
Coal mines and coke[3]	21	592	804,259		22	27.4
Nonmetal mines and mills (other than sand and gravel and stone)	48	946	2,289,603	1	25	11.4
Sand and gravel plants	89	453	612,683		7	11.4
Stone quarries and plants	39	333	583,033	1	14	25.7
Ferrous and nonferrous mines and mills (excluding uranium)	10	523	840,166	1	11	14.3
Uranium mines and mills	62	1,203	2,547,004	2	83	33.4
Total	269	4,050	7,676,748	5	162	21.8

[1] Excludes employees in all mineral fuels industries except the coal industry, as well as officeworkers.
[2] Preliminary figures.
[3] New operation.

Green River basins, and oil characteristics in the Greater Clareton area. Two reports on the investigations were published.[2]

The Bureau of Mines studied carbonizing properties of Wyoming coals, rock mechanics at trona mining operations, and mineral resources and their economic feasibility in the Wind River Indian Reservation. The Bureau published studies on sulfur, thorium, rare earths, and industrial-engineering practices.[3]

The Federal Geological Survey continued geologic mapping and studying of uranium ore deposits in the Shirley basin. Reports on other areas were published.[4]

The Geological Survey of Wyoming published a report on titaniferous black sandstone.[5] Geologists continued mapping and mineral studies in the Absaroka Range, with special emphasis on the Kirwin district. The Natural Resources Research Institute of Wyoming published results of research work on petroleum and coal tars.[6]

[2] White, Eliot J., Oren C. Baptist, and Carlon S. Land. Physical Properties and Clay Mineral Contents Affecting Susceptibility of Oil Sands to Water Damage, Powder River Basin, Wyo. BuMines Rept. of Inv. 6093, 1962, 20 pp. Tisot, P. R. Properties of Green River Oil Shale. J. Chem. and Eng. Data, v. 7, No. 3, July 1962, pp. 405–410.

[3] Kelly, F. J. Sulfur Production and Consumption in Eight Western States: Arizona, Colorado, Nebraska, New Mexico, North Dakota, South Dakota, Utah, and Wyoming. BuMines Inf. Circ. 8094, 1962, 85 pp.

Borrowman, S. R., and J. B. Rosenbaum. Recovery of Thorium from a Wyoming Ore. BuMines Rept. of Inv. 5917, 1962, 8 pp. Kelly, Francis J. Technological and Economic Problems of Rare-Earth-Metal and Thorium Resources in Colorado, New Mexico, and Wyoming. BuMines Inf. Circ. 8124, 1962, 38 pp. Redmon, Donald E. Industrial Engineering Practice at Selected Metal Mines in Western States. BuMines Inf. Circ. 8097, 1962, 81 pp.

[4] Love, J. D. Split Rock Formation (Miocene) and Moonstone Formation (Pliocene) in Central Wyoming. Geol. Survey Bull. 1121–I, 1961, 37 pp.

Love, J. D., and Paul D. Blackmon. Alunite on Aspen Mountain, Southwestern Wyoming. Geol. Survey Pro. Paper 450–D, 1962, pp. D11–D15.

[5] Houston, R. S., and J. R. Murphy. Titaniferous Black Sandstone Deposits of Wyoming. Geol. Survey of Wyo. Bull. 49, November 1962, 120 pp.

[6] Law, Ralph D. Petroleum and Coal Tar Research to 1961. Natural Resources Research Institute, April 1963, 34 pp.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The value of mineral fuels increased from $397.9 million in 1961 to $410.3 million in 1962. Petroleum had the greatest value, followed by natural gas, natural gas liquids, and coal.

Coal (Bituminous).—Coal production increased 2 percent, but the value of output decreased 4 percent. Declines in production caused by the closing of the Superior D. O. Clark and Rock Springs No. 8 underground coal mines by The Union Pacific Coal Co. were more than offset by increases at Hanna Basin Coal Co., The Kemmerer Coal Co., Rosebud Coal Sales Co., and Wyodak Resources Development Corp. Production came from 18 mines in the following counties, listed in order of production: Converse, Campbell, Carbon, Sheridan, Lincoln, Sweetwater, and Hot Springs. Output from properties yielding less than 1,000 tons, all in Fremont and Sublette Counties, was not included in the production figures.

Construction of the first-stage unit of the Utah Power & Light Co. coal-based powerplant was expected to be completed in June 1963. Coal requirements for this 150,000-kilowatt unit, estimated at 600,000 tons per year, were to be provided under contract by The Kemmerer Coal Co. from the new Sorensen strip mine near the plant. Morrison-Knudsen Co., Inc., was the contractor for the stripping and mining operations. The coal company allocated blocks of coal reserves from the thick Elkol seam to meet the needs of the plant for the next 40 years.

TABLE 3.—Coal (bituminous) production, by counties

(Excludes mines producing less than 1,000 short tons annually)

County	1961		1962	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Campbell	447,447	$1.29	482,781	$1.30
Carbon	378,593	2.60	462,866	2.45
Converse	826,422	3.80	766,314	4.02
Fremont	1,234	6.17	----	----
Hot Springs	10,488	9.64	11,449	8.78
Lincoln	282,159	3.28	333,486	3.27
Sheridan	348,828	3.36	356,636	3.36
Sweetwater	233,637	7.13	155,192	6.21
Total	2,528,808	3.39	2,568,724	3.20

[1] Value received or charged for coal f.o.b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked, as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

American Humates, Inc., completed a plant near Glenrock in July and started processing a balanced fertilizer using a coal-like mineral, leonardite, as the principal raw material. The product, called Aqua Humus, was high in humic acid.

A pilot plant jointly operated by FMC Corp. and United States Steel Corp. processed several thousand tons of coke briquettes from subbituminous coal mined near Kemmerer. Tests were reported as

successful using the coke to process low-grade phosphate in electric furnaces and in the iron ore blast furnaces.

Pacific Power & Light Co. announced a research program to explore new uses for Wyoming coal. One phase of the program included investigations to produce electrode coke in a pilot plant to be constructed adjacent to the company Dave Johnston powerplant near Glenrock. The company continued constructing its third generating unit, scheduled for completion in 1964; with the completion of the new unit, the capacity of the plant was to be increased to 400,000 kilowatts, the largest steam-electric plant in the Rocky Mountain region. Pacific Power & Light and Utah Power & Light planned 570 miles of 230,000-volt-capacity electric transmission lines to augment the interconnection among and coordinated operations of five power systems. This joint construction, estimated to cost $22 million, was scheduled for completion in 1965.

Gunn-Quealy Coal Co. reported intentions of constructing a small demonstration oven for coal carbonization at Rock Springs. This company, with the same management as that of The Kemmerer Coal Co., was operating the only railhead mine in the Rock Springs area at the end of 1962.

Natural Gas.—Natural gas production and value increased 5 percent and 23 percent, respectively. Output totaled 205 billion cubic feet and came from fields in Big Horn, Campbell, Carbon, Converse, Crook, Fremont, Hot Springs, Johnson, Laramie, Natrona, Niobrara, Park, Sublette, Sweetwater, Uinta, Washakie, and Weston Counties. Reserves[7] as of January 1, 1963, were 4,225 billion cubic feet, 5 billion cubic feet more than those of 1961. A total of 80 successful gas wells was drilled, 15 less than in 1961. Seventeen new natural gas discoveries resulted, compared with ten in 1961. Natural-gas-well completion data, by counties, are included in table 4.

Natural Gas Liquids.—Natural gas was processed and natural gasoline, butane, and propane were recovered at 23 plants in 14 counties. Production of LP gases, propane, and butane was 13 percent greater than in 1961, with 149.4 million gallons being recovered. Natural gasoline output, 78.8 million gallons, was 3 percent more than in 1961. Hy-Gas Products Co. processed natural gas in a new plant at the Clareton field near Newcastle, and California Oil Co. began constructing two plants at the Birch Creek field near Big Piney.

Petroleum.—Production of crude petroleum advanced to 145.2 million barrels, an increase of 3.2 million barrels or 2 percent above that of 1961. Output in 1962 came from 267 fields, of which 30 recovered more than 1 million barrels. Wildcat drilling, 12 wells less than in 1961, resulted in 46 discoveries, 14 more than in 1961. Twenty-nine of the discoveries produced crude petroleum, and 17 natural gas. Only 440 development wells were drilled, compared with 604 in 1961. The success ratio for development wells declined from 73.7 in 1961 to 68.2 percent. Fifty-seven percent of the exploratory drilling was done in the Powder River basin; 18 percent in the Green River basin; 11 percent in the Big Horn River basin; 7 percent in the Wind River basin; 6 percent in the Hanna, Laramie, and Denver-Julesburg basins; and 1 percent in Teton County. The distribution of the new

[7] Oil and Gas Journal. V. 61, No. 4, Jan. 28, 1963, p. 169.

discoveries was Powder River basin, 21 oil and 3 gas; Green River basin, 3 oil and 8 gas; Big Horn basin, 2 oil and 2 gas; Wind River basin, 1 oil and 4 gas; Hanna basin, 1 oil; and Denver-Julesburg basin, 1 oil. The largest producing fields, each with more than 5 million barrels output, included Elk Basin, Park County, 21 million barrels; Hamilton Dome, Hot Springs County, 9 million barrels; Salt Creek, Natrona County, 7 million barrels; Oregon Basin, Park County, 6 million barrels; Grass Creek, Hot Springs County, more than 5 million barrels; and Garland, Big Horn County, more than 5 million barrels.

Nine refineries had a combined output of 45.3 million barrels, up 6.2 percent from 1961. Refineries were operated by American Oil Co., Mobile Oil Co. Division, Socony Mobile Oil Co., Inc., and Texaco Inc. at Casper; C & H Refinery at Lusk; Empire State Oil Co. at Thermopolis; Frontier Refining Co. at Cheyenne; Husky Oil Co. at Cody; Sinclair Refining Co. at Sinclair; and Sioux Oil Co. at Newcastle.

TABLE 4.—Wildcat- and development-well completions in 1962, by counties

County	Crude	Condensate	Gas	Dry	Service	Total	Footage
Wildcat:							
Albany				1		1	10,300
Big Horn			1	16		17	57,600
Campbell	10			64		74	552,400
Carbon	1			14		15	78,500
Converse	1		3	9		13	69,900
Crook	6			48		54	274,800
Fremont	1		4	22		27	191,700
Goshen				1		1	1,700
Hot Springs				5		5	23,000
Johnson	1			6		7	28,200
Laramie	1			4		5	39,500
Lincoln				5		5	27,900
Natrona	1			28		29	120,800
Niobrara	1			8		9	55,100
Park	1		1	8		10	45,200
Platte				2		2	10,200
Sheridan				7		7	44,900
Sublette	1		1	6		8	58,300
Sweetwater	2		7	44		53	370,000
Teton				4		4	19,000
Uinta				3		3	21,500
Washakie	1			7		8	35,000
Weston	1			21		22	136,900
Total	29		17	333		379	2,272,400
Development:							
Albany				1		1	5,800
Big Horn				3		3	4,400
Campbell	44			33		77	620,500
Carbon	1			1		2	9,200
Converse	11		4	4		19	114,600
Crook	11			17		28	179,400
Fremont	9	3	1	6		19	107,400
Hot Springs	9			1		10	41,200
Johnson	8		1	7	1	17	57,700
Laramie				1		1	7,400
Lincoln			8	4		12	72,400
Natrona	56			6	2	64	105,900
Niobrara	4			4		8	41,200
Park	30			5		35	157,900
Sublette	24		35	11		70	340,600
Sweetwater	9	1	14	19		43	205,900
Washakie	6			1	1	8	29,700
Weston	11			10	2	23	89,300
Total	233	4	63	134	6	440	2,190,500
Total all drilling	262	4	80	467	6	819	4,462,900

Source: Oil and Gas Journal.

TABLE 5.—Crude petroleum production, by counties[1]

(Thousand barrels)

County	1961	1962[2]	Principal fields in 1962, in order of production
Albany	367	780	Quealy.
Big Horn	11,171	11,065	Garland, Byron, Bonanza.
Campbell	4,840	5,639	Raven Creek, Rozet, Dead Horse Creek.
Carbon	3,458	3,379	Wertz, Rock River.
Converse	4,284	4,014	Big Muddy, Glenrock South.
Crook	5,083	6,321	Coyote Creek, Donkey Creek, Miller Creek, Robinson Ranch.
Fremont	13,668	13,714	Beaver Creek, Steamboat Butte, Winkleman Dome, Big Sand Draw.
Goshen	25	11	Torrington.
Hot Springs	20,942	22,245	Hamilton Dome, Grass Creek, Murphy Dome, Little Buffalo Basin.
Johnson	7,227	6,678	Sussex, North Fork, Meadow Creek.
Laramie	288	366	Horse Creek
Natrona	12,604	13,309	Salt Creek, Grieve Unit.
Niobrara	1,191	1,194	Lance Creek, Little Buck Creek, Ant Hills.
Park	33,760	36,594	Elk Basin, Oregon Basin, Fourbear, Frannie.
Sheridan	824	748	Ash Creek.
Sublette	1,764	2,364	Big Piney Shallow, Tip Top Shallow, Birch Creek, La Barge.
Sweetwater	11,205	10,377	Patrick Draw, Lost Soldier, Arch Unit.
Uinta	322	93	Church Buttes, Spring Valley.
Washakie	2,907	2,428	Cottonwood Creek, Worland, Slick Creek.
Weston	6,007	3,848	Fiddler Creek, Kummerfeld, Lonetree Creek.
Total	141,937	145,167	

[1] Based on Rocky Mountain Oil Reporter data adjusted to Bureau of Mines total.
[2] Preliminary figures.

Construction of a new 6-inch products pipeline between Sinclair and Denver, Colo., a distance of 210 miles, was planned by Sinclair Oil Corp. and Skelly Oil Co. Initial pipeline capacity was programmed for 10,000 barrels, or 420,000 gallons per day, of refined products including gasoline, kerosine, and heating oils from the Sinclair refinery to the expanding Denver market. Work on the pipeline was to start in June and to be completed about November 1963. Plans also included a project for modernizing the Sinclair refinery in 1963.

TABLE 6.—Oil and gas discoveries in 1962

County and field	Well	Operator	Location			Producing formation	Producing interval (feet)	Total depth (feet)	Initial production		Completion date	Remarks
			Section	Township	Range				Barrels oil per day	Thousand cubic feet of gas per day		
Big Horn County:												
Torchlight.	No. 10 Orchard Unit.	Pan American Petroleum Corp.	24	51 N.	93 W.	Madison Big Horn	3,381, 3,606 4,119–4,133	5,629	51	--------	Mar. 12	Pumped. Old well new zone.
Campbell County:												
Am-Kirk	No. 1-D Federal	Ambassador Oil Corp.	6	46 N.	70 W.	Minnelusa	10,222–10,250	10,415	408	--------	Oct. 2	Pumped.
Halverson	No. 1 Halverson	R. E. Hudson	8	49 N.	69 W.	do	8,546–8,562	8,726	464	--------	June 18	Pumped. Old well new zone.
Raven Creek	No. 32-28A Reel	Shell Oil Co	28	49 N.	69 W.	do	8,506–8,520	8,600	260	--------	Nov. 3	Pumped.
North Rainbow Ranch.	No. 1 Carter	Marin Oil Co	24	49 N.	71 W.	Muddy	7,984–8,006	8,370	336	--------	May 1	Do.
Rozet	No. 1 Pfleler	Stuarco Oil Co., Inc.	8	50 N.	69 W.	Minnelusa	8,193–8,198	8,280	513	--------	July 23	Pumped. Old well new zone.
Gillette	No. 1 Marshall-A.	Tenneco Oil Co	35	51 N.	72 W.	Muddy	8,010–8,020	9,851	99	--------	Oct. 19	Flowed.
Adon Road	No. 1 Wallace	Anschutz Drilling Co., Inc.	26	52 N.	70 W.	Minnelusa	7,812–7,824	8,012	590	--------	Sept. 10	Pumped.
Wildcat	No. 1 Government-Davies.	J. M. Huber Corp	20	54 N.	69 W.	Muddy	5,772–5,776	5,824	33	--------	Feb. 8	Do.
Wildcat	No. 1 Norfolk	Reco Oil & Gas Co	12	54 N.	71 W.	Minnelusa	7,380–7,390	7,585	768	--------	July 24	Do.
Converse County:												
Wildcat	No. 1 Government-Eddy.	Brinkerhoff Drilling Co.	33	33 N.	68 W.	Teapot	6,935, 6,954	7,323	--------	203	Apr. 24	Flowed.
Flat Top	No. 6 Belco-Shawnee.	Belco Petroleum Corp.	13	33 N.	69 W.	Lance Mesaverde	4,309, 4,671 6,879	7,105	71	1,578 1,450	June 12	Flowed. Old well new zone.
Ridge	No. 1 Wanek	Cities Service Petroleum Co.	11	34 N.	68 W.	Teapot Mesaverde	6,290–6,303	6,670	78	164	Sept. 7	Flowed.
Lebar	No. 1-23 Government.	Kramer-Huff Drilling Co.	23	34 N.	70 W.	Lewis	6,660–6,670	6,754	38	--------	Aug. 25	Pumped.

Crook County: South Robinson Ranch (Area) Wildcat.	No. 1 Government-Hoffhine.	Arrowhead Exploration Co.	5	49 N.	67 W.	Minnelusa	6,266–6,271	6,368	373		Dec. 16	Do.
Wood	No. 1 Wood	Sam Gary	13	51 N.	68 W.	Lakota	5,126, 5,133 5,139	6,700	135		Sept. 5	Do.
Flag Butte	No. 1 Harris-Simpson.	John H. Trigg	10	52 N.	68 W.	Muddy	5,430–5,446	7,284	22		Sept. 15	Do.
Semlek	No. 1 Semlek	M.K.M. Oil Co. and Texaco Inc.	27	52 N.	68 W.	Minnelusa	7,016–7,023	7,183	537		Oct. 1	Do.
Corral Creek	No. 1 Gibson	Davis Oil Co	35	55 N.	68 W.	do	6,033–6,038	6,150	825		Oct. 29	Do.
Fremont County: Muskrat	No. A–4 Unit	Sinclair Oil & Gas Co.	2	33 N.	92 W.	Phosphoria	7,318–7,328	7,654	146	3,100	May 18	Flowed. Old well new zone.
Thompson Ranch	No. 1 Unit	Shell Oil Co	16	35 N.	90 W.	Lance	5,579–5,586 5,596–5,610	8,017		500	June 30	Flowed.
Moneta Hills	do	Pan American Petroleum Corp.	31	38 N.	90 W.	do	9,738–11,294	11,653		130	June 29	Do.
Frenchie Draw Unit.	No. 2–B Unit	Humble Oil & Refining Co.	21	37 N.	90 W.	Fort Union	10,115–10,143 10,416–10,447	11,339		2,740	June 25	Do.
Johnson County: West Barber Creek.	No. 1 Federal	Ambassador Oil Corp.	18	50 N.	76 W.	Ferguson	6,871–6,872	7,006	63		Feb. 6	Pumped.
Laramie County: South Pine Bluffs.	No. 28–1 Soule	C. C. Gross, Jr., et al	28	14 N.	60 W.	J sand	Notch at 7,293.	7,375	221		Oct. 30	Do.
Natrona County: Poison Spider.	No. 27 Government.	American Industries, Inc.	12	33 N.	83 W.	Tensleep	2,356–2,372 2,406–2,416	2,486	50		Dec. 7	Pumped. Old well new zone.
Niobrara County: Cow Gulch.	No. 1 Government.	The Coronado Co	4	36 N.	62 W.	Bell sand	2,401–2,423	2,755	234		Mar. 23	Pumped. Old well new zone.
Park County: McCulloch Peak.	do	Atlantic Refining Co. and Alpine Oil Co., Inc.	21	54 N.	100 W.	Fort Union	3,487–3,492	9,904		495	Jan. 12	Flowed.
Sublette County: Birch Creek	No. 18 Unit	California Oil Co	25	27 N.	113 W	Almy	2,447–2,462	2,576	379		June 21	Flowed. Old well new zone.
Goat Hill Unit	No. 3 Unit	Clark Oil & Refining Corp.	32	31 N.	113 W.	do	2,238–2,240 2,259–2,261	5,415		6,217	June 11	Flowed.

TABLE 6.—Oil and gas discoveries in 1962—Continued

County and field	Well	Operator	Location			Producing formation	Producing interval (feet)	Total depth (feet)	Initial production		Completion date	Remarks
			Section	Township	Range				Barrels oil per day	Thousand cubic feet of gas per day		
Sweetwater County:												
Little Snake	No. 4-21 Little Snake.	Union Oil Company of California.	21	12 N.	95 W.	Wasatch	4,319–4,327 4,337–4,340 4,795–4,802 4,913–4,918	5,350		1,600	Sept. 9	Flowed.
Pretty Water Creek.	No. 21-11 Government.	U.S. Natural Gas Corp.	11	15 N.	104 W.	Frontier	3,607–3,621	3,800		2,640	Aug. 22	Do.
Bitter Creek	No. 3-2 Unit	Continental Oil Co.	3	16 N.	99 W.	Lance	7,865–7,896	10,239		2,600	May 27	Do.
Wildcat	No. 1 Government.	Kilroy Company of of Texas, Inc.	14	18 N.	98 W.	Almond	6,425–6,436 6,446–6,490	6,843		5,690	Jan. 6	Do.
Sixmile Spring	No. 20-1 Government.	B. E. Oil, Inc	20	18 N.	104 W.	Frontier	4,087	4,750		2,200	Aug. 5	Do.
Wildcat	No. 1 Government-Rowland.	Chandler-Simpson, Inc.	2	19 N.	100 W.	Almond	2,567–2,573	3,061		1,460	Jan. 10	Do.
Red Hill	No. 3 State-C	do	36	20 N.	100 W.	Lance	1,399–1,401	3,065	96		Oct. 23	Pumped.
Ten Mile Draw Unit.	No. 4 Unit	John L. Kemmerer, Jr.	33	21 N.	99 W.	do	2,136–2,146	3,860		2,785	Oct. 27	Flowed.
Washakie County:												
Wildcat	No. 1 State-B	L. W. Lease et al	16	48 N.	90 W.	Tensleep	2,108–2,128	2,128	5		Jan. 30	Pumped.
Weston County:												
Jiggs Thompson.	No. 1 Federal	A. L. Schlaikjer	28	41 N.	64 W.	Dakota	6,067–6,070	6,099	114		Jan. 8	Do.

Source: Petroleum Information, 1962 Resume, Oil and Gas Operations in the Rocky Mountain Region.

NONMETALS

Nonmetal production in 1962 increased 21 percent in value, from $35.5 million to $42.9 million.

Cement.—Cement production was up 9 percent, compared with that of 1961. Monolith Portland Midwest Co., the only producer in the State, expended nearly $1 million in modernizing its facilities at Laramie, increasing plant capacity by 100,000 barrels of cement per year. The company mined cement rock, coal, gypsum, limestone, and sandstone from deposits near Laramie for use in producing cement, which was marketed in Wyoming and neighboring States.

Clays.—Clays produced in Wyoming included bentonite, fire clay, and miscellaneous clay. With an output of 957,000 tons valued at $10.9 million, bentonite was the most important clay produced. Wyoming led the Nation in production of high-swelling bentonite. This unique clay had many useful applications but was used chiefly in oil-well-drilling mud, iron and steel foundry sands, pelletizing taconite iron ore, and sealing ditches and ponds. Some of the companies in Wyoming began shipping bentonite to taconite processing plants in Canada. Reportedly, Magnet Cove Barium Corp. became interested in undeveloped deposits of high-swelling bentonite near Worland, and Black Hills Bentonite Co. continued to develop deposits near Kaycee. Wyo-Ben Products Co. installed a new grinding mill in its plant near Greybull; capacity of the plant increased to 33 tons per hour. Columbia-Geneva Steel Division, United States Steel Corp., awarded a contract to Magnet Cove Barium Corp. to supply bentonite to the Atlantic City iron ore project for use in pelletizing taconite concentrates. Fire clay production was approximately equal to that of 1961.

The Idealite Co. at Laramie, Interstate Brick Co. north of Evanston, and Lovell Clay Products Co. at Lovell produced miscellaneous clay; total output was below that of 1961.

Gem Stones.—More than 66 gem-collecting organizations and commercial dealers and hobbyists contributed to the recorded gem-stone production valued at $85,000, $2,000 more than in 1961. Gem materials collected included jade (nephrite), agate, fossils, petrified wood, alabaster, and mineral specimens.

Gypsum.—The Big Horn Gypsum Co. produced and used gypsum in manufacturing plasterboard at Cody. Wyoming Construction Co. supplied gypsum to the Monolith Portland Midwest Co. for use in processing cement. Gypsum produced in 1955 by Wyoming Gulf Sulphur Co. was marketed in 1962 by Multi Mineral Production Corp. for agricultural use. Recorded total gypsum output advanced 67 percent over that of 1961.

Lime.—Quicklime was produced from limestone at three beet-sugar refineries. Holly Sugar Corp. operated plants at Torrington and Worland, and The Great Western Sugar Co. operated a plant at Lovell.

Phosphate Rock.—Phosphate rock output increased 21 percent after 2 consecutive years of decreasing production. San Francisco Chemical Co., the only producer, operated an upgrading plant at Sage in Lincoln County and processed ores from Utah and Wyoming. Most of the processed rock was shipped to out-of-State purchasers for

TABLE 7.—Sand and gravel production in 1962, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Albany	262	$166	Park	88	$86
Big Horn	26	26	Platte	319	249
Campbell	163	204	Sheridan	106	110
Carbon	59	29	Sublette	243	121
Converse	82	78	Sweetwater	509	331
Crook	2	3	Teton	69	68
Fremont	690	535	Uinta	22	50
Goshen	14	14	Washakie	43	83
Hot Springs	9	8	Weston	75	73
Johnson	249	344	Yellowstone National Park	35	21
Laramie	36	31	Undistributed	3,238	4,515
Lincoln	224	118			
Natrona	1,206	886	Total	7,769	8,104

TABLE 8.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1961		1962	
	Quantity	Value	Quantity	Value
Commercial operations:				
Construction sand:				
Building	116	$183	116	$181
Paving	44	58	118	83
Railroad ballast	17	8	5	1
Fill	2	4	34	13
Other	9	5	2	1
Total	188	258	275	279
Construction gravel:				
Building	338	453	240	326
Paving	1,399	1,330	1,779	1,255
Railroad ballast	122	61	152	31
Fill	7	9	9	7
Other	3	2	7	8
Miscellaneous gravel	12	11	49	46
Total	1,881	1,866	2,236	1,673
Total sand and gravel	2,069	2,124	2,511	1,952
Government-and-contractor operations:				
Sand:				
Building	25	52	(1)	(2)
Paving	379	93	86	47
Total	404	145	86	47
Gravel:				
Building	80	151	128	115
Paving	4,051	2,896	4,990	5,967
Fill	10	10	34	13
Other	55	30	20	10
Total	4,196	3,087	5,172	6,105
Total sand and gravel	4,600	3,232	5,258	6,152
All operations:				
Sand	592	403	361	326
Gravel	6,077	4,953	7,408	7,778
Total	6,669	5,356	7,769	8,104

[1] Less than 500 short tons.
[2] Less than $500.

manufacturing phosphoric acid and superphosphate fertilizers. The Federal Bureau of Land Management granted Susquehanna-Western, Inc., phosphate prospecting permits on 4,022 acres of Federal land along the east flank of the Wind River Range southeast of Lander. Susquehanna-Western, Inc., reported developing an economically feasible process for treating low-grade phosphate rock deposits in the area. Officials were investigating the use of sulfuric acid and uranium processing facilities at Riverton for making phosphoric acid and fertilizer products.

Pumice.—Pumice (scoria) output increased in 1962. Tongue River Stone Co. of Sheridan, the State's only producer, crushed and sized scoria for use as railroad ballast.

Sand and Gravel.—Sand and gravel output was increased 16 percent, and the value was 51 percent greater than in 1961. Producers reported 43 commercial operations in 19 counties and 26 Government-and-contractor operations in 15 counties and Yellowstone National Park. According to reports, 86 percent of the sand and gravel was prepared for use by washing, crushing, or screening; the remainder was used as pit run. Production distribution was 90 percent for paving, 6 percent building, 2 percent railroad ballast, 1 percent fill, and 1 percent miscellaneous. Output was highest in Natrona, Fremont, and Sweetwater Counties.

Sand and gravel was used predominantly in road construction. Under the 1962 Wyoming State highway program,[8] road construction contracts totaled $32.1 million: $2.7 million in contracts was awarded for roads financed by the State, $10.9 million for roads in the Federal-Aid Primary and Secondary (ABC) program, and $18.5 million under the interstate highway system. Planned expenditures for road construction in 1963 totaled $44 million: $3 million by the State, $12 million with ABC funds, and $29 million for the interstate program. In the national interstate program for 1962,[9] 63.6 miles of road was completed and 73.8 miles of road improved to acceptable standards in Wyoming. With 316.5 miles of road open to traffic since the program started July 1, 1956, Wyoming was ranked 16th in total miles completed. Roads under construction totaled 72.8 miles, and roads in engineering or right-of-way status totaled 67.8 miles. The total adjusted designated mileage for the State was 916.7 miles, of which 459.6 miles was in preliminary status or not started. Fifty percent of the interstate program in Wyoming was completed by the end of 1962.

Sodium Carbonate and Sulfate.—Output of soda ash (sodium carbonate), processed from trona, increased by 33 percent in 1962, establishing a new record. Trona was mined by two companies from ancient lake beds occurring deep below the surface in the Green River basin in southwestern Wyoming.

FMC Corp., Inorganic Chemical Division, formerly Intermountain Chemical Co., reported a large increase in production of soda ash. During the year, a $4 million expansion program was completed, and the plant capacity was increased to about 700,000 tons of soda

[8] Engineering News-Record. Road Contractors Will Set a Record. V. 170, No. 16, Apr. 18, 1963, pp. 21–23.
[9] Bureau of Public Roads. Quarterly Report on the Federal-Aid Highway Program, Dec. 31, 1962. Press Release BPR 63–10, Feb. 10, 1963.

ash per year. Stauffer Chemical Co. of Wyoming completed preliminary development of its Big Island mine and plant construction and began producing soda ash in June. The company later announced plans for expansion from 200,000 to 400,000 tons of refined soda ash per year. The expansion program was to start in the summer of 1963 and be completed by the fall of 1964.

William E. Pratt produced a small quantity of natural sodium sulfate, which was shipped to consumers in the Midwest for use as a mineral additive to stock feed.

Stone.—Stone production and value decreased 32 percent and 8 percent, respectively, in 1962. Seventy-five percent of the stone output was crushed limestone; 20 percent was crushed granite; the remaining 5 percent included basalt, crushed miscellaneous stone, crushed sandstone, and dimension sandstone. Limestone was used for producing cement and lime and as railroad ballast, riprap, and road construction aggregate; crushed granite for railroad ballast, road construction, and riprap; crushed sandstone for road construction and for producing cement; and dimension stone in constructing and decorating buildings.

Sulfur.—Shipments of sulfur recovered from hydrogen sulfide-bearing natural gas increased from 79,200 to 89,200 long tons in 1962 and was valued at $730,600.

Sulfur recovery plants were operated by Gas Processors, Inc., Big Horn County; Pan American Petroleum Corp. and Texaco Inc., Park County; and Pan American Petroleum Corp. and Texas Gulf Sulphur Co., Washakie County.

At its uranium mill near Riverton, Susquehanna-Western, Inc., operated a 200-ton-per-day sulfuric acid manufacturing unit. Western Nuclear, Inc., completed a sulfuric-acid plant with a capacity of 100 tons per day at its Split Rock uranium mill near Jeffrey City. Most of the sulfuric acid from these two plants was consumed in processing uranium ores at mills in the Gas Hills and Shirley basin.

Vermiculite.—Golden Clover Corp. produced a small tonnage of vermiculite from the Platte mine near Encampment, Carbon County.

METALS

Combined value of production in the metals group—beryllium concentrate, iron ore, uranium ore, and vanadium—decreased 1 percent, from $32.8 million in 1961 to $32.6 million in 1962.

Beryllium.—Approximately 1 ton of hand-cobbed beryl was recovered from two small operations in Fremont County.

Iron Ore.—The value of iron ore (shipments) which came from three operations was greater than that of 1961. This increase in value resulted because the Atlantic City iron ore project of the Columbia-Geneva Steel Division, United States Steel Corp., began operations in August. Agglomerates produced from taconite-type iron ore were shipped by rail to Provo, Utah, for use in the company steel plant. A publication on the iron deposits was being prepared for release in mid-1963.[10]

[10] Bayley, Richard W. A. Preliminary Report on the Precambrian Iron Deposits Near Atlantic City, Wyo. U.S. Geol. Survey Bull. 1142–C, 1963, 23 pp.

The Colorado Fuel and Iron Corp. (CF&I) continued to supply its steel plant at Pueblo, Colo., with direct-shipping-grade iron ore (hematite) from the Sunrise mine. Development continued on the seventh level (750 feet below the surface), and new ore-handling facilities were constructed at the shaft station. In Albany County, Magnetite Products Corp. produced iron concentrate to be used as aggregate in concrete coatings of underwater pipe in Texas.

Uranium Ore.—Uranium ore production (shipments) and value declined 14 percent and 9 percent, respectively. Purchase contracts that became effective in late 1961 between milling companies and the Atomic Energy Commission (AEC) provided for purchase of uranium oxide concentrates. Formerly, the purchase contracts were based on pounds of uranium oxide in ores. The new agreements, negotiated with milling companies separately, caused companies to mine less but higher grade ore. Some ore mined within the State was processed in mills in South Dakota and Colorado. The State was ranked second in the Nation according to concentrates processed from ores mined within the State and purchased for $48.2 million.[11]

Five mills were operated throughout the year; the sixth mill, completed by Petrotomics Co. in the Shirley basin, began operating in April. Western Nuclear, Inc., completed the Spook uranium ore upgrading plant north of Douglas in April. Uranium ore concentrate from this plant in the form of a slurry was trucked to the company's Split Rock mill at Jeffrey City for final processing. Susquehanna-Western, Inc., announced that the carbonate leaching section of its uranium mill at Riverton was closed in April because high-lime ores were unavailable from the Pryor and Little Mountain districts in Wyoming and Montana.

TABLE 9.—Stone production in 1962, by counties

County	Short tons	Value	County	Short tons	Value
Albany	(1)	(1)	Natrona	2,450	$2,916
Big Horn	20,572	$25,183	Platte	(1)	(1)
Carbon	61	789	Sweetwater	(1)	(1)
Converse	(1)	(1)	Teton	26,120	26,420
Crook	(1)	(1)	Undistributed	1,150,207	2,055,012
Goshen	268	10,720			
Laramie	525,004	887,696	Total	1,754,682	3,053,736
Lincoln	30,000	45,000			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Utah Construction & Mining Co. began testing the feasibility of solution-type mining at its properties. According to a published report,[12] the company recovered several thousand pounds of uranium oxide from uranium-bearing slurry. The company at its property in the Shirley basin operated an underground mine with water and ground permeability problems.

Atlas Corp., Atlas Minerals Division, began developing the ore bodies from the 500-foot lisbon shaft (formerly sunk by the Hidden

[11] U.S. Atomic Energy Commission. Press Release No. 367, Feb. 26, 1963.
[12] Annual Report of the State Inspector of Mines of Wyoming for Year Ending Dec. 31, 1962, p. 52.

TABLE 10.—Mine production of uranium ore, by counties[1]

County	1961				1962			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]
Big Horn	3	(3)	(3)	(3)	5	732	3,905	$15,666
Campbell	8	2,188	14,631	$61,670	4	(3)	(3)	(3)
Carbon	13	276,975	1,411,223	5,789,376	19	177,243	1,413,980	6,162,770
Converse	11	28,841	129,384	522,448	5	16,771	77,957	319,443
Crook	7	75,866	352,205	1,443,379	5	93,333	415,669	1,671,486
Fremont	32	1,036,605	4,969,086	19,928,297	35	878,596	4,134,317	16,643,099
Johnson					1	61	162	412
Natrona	4	98,714	208,029	447,462	5	(3)	(3)	(3)
Niobrara	1	(3)	(3)	(3)				
Undistributed		1,875	6,869	25,001		135,048	340,220	902,484
Total	79	1,521,064	7,091,427	28,217,633	79	1,301,784	6,386,210	25,715,360

[1] Receipts at mills based on data supplied to the Bureau of Mines by AEC.
[2] F.o.b. mine value; base price, grade premiums, and exploration allowance.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Splendor Mining Co.), the first integrated underground mining operation in the Gas Hills; however, underground methods were used to recover irregular pods of uranium ore extending into the walls of open pits. Open-pit mining for uranium ore was carried out in the Dry Fork area north of Douglas and near Baggs. Underground mines were operated near Hulett in Crook County and in the Crooks Gap and Copper Mountain areas of Fremont County.

AEC announced in November a stretchout program for extending procurement of uranium oxide concentrates through 1970. Uranium milling companies were to be allowed to defer a portion of the concentrate contracted for delivery in the 1965–66 period to the 1967–68 period. A quantity of concentrate equal to the quantity deferred was to be purchased in the 1969–70 period at prices fixed by AEC based on 85 percent of the allowable production cost per pound plus $1.60, subject to a maximum price of $6.70 per pound. Small mining properties producing less than 20,000 pounds of uranium oxide annually were to be permitted to participate in the program, up to an overall maximum of 1 million pounds per year, without being required to defer production. Effects of this program were to extend purchases at a deferred rate through 1970.

Vanadium.—Vanadium metal production from ores mined in Wyoming increased 11 percent. The vanadium was recovered as a by-product of uranium ores processed in the mill of Mines Development, Inc., at Edgemont, S. Dak.

REVIEW BY COUNTIES

Albany.—Value of cement production from the Laramie plant of Monolith Portland Midwest Co. accounted for most of the county mineral production value. The company operated the plant at the highest level in the plant's history. Cement rock for the operation came from an open-pit mine 12 miles west of the plant, limestone and sandstone from 5 miles east of the plant, and gypsum from 40

miles southwest, near Wood's Landing. In a plant adjacent to the cement operation, the Idealite Co. processed shale to produce lightweight aggregate. Shale from the Benton formation was calcined to 2,100° F, screened, and shipped to consumers. Concrete products made with the aggregate were both high strength and lightweight. The Idealite Co. also produced pozzolan by grinding calcined shale to cement fineness. Much of the pozzolan was used as a concrete admixture for the Flaming Gorge Dam and with oil-well drilling cement by the oil and gas industry. Four commercial sand and gravel companies reported a total output of 227,000 tons.

Petroleum production, 112 percent greater than in 1961, came from 36 wells in 4 fields; Quealy Dome field had the largest production with an annual output of 649,000 barrels.

TABLE 11.—Value of mineral production in Wyoming, by counties

County	1961	1962 [1]	Minerals produced in 1962, in order of value
Albany	$5,876,464	$6,786,568	Cement, petroleum, stone, iron ore, sand and gravel, clays, gypsum.
Big Horn	[2] 31,490,515	31,742,731	Petroleum, clays, natural gas, lime, sand and gravel, stone, uranium ore, gem stones.
Campbell	[2] 12,873,003	15,223,355	Petroleum, coal, sand and gravel, LP gases, natural gas, uranium ore, vanadium.
Carbon	[2] 15,834,828	16,216,946	Petroleum, uranium ore, coal, natural gas, LP gases, sand and gravel, gem stones, vermiculite, stone.
Converse	[2] 15,623,056	14,691,867	Petroleum, coal, natural gasoline, LP gases, uranium ore, natural gas, sand and gravel, stone, vanadium, gem stones.
Crook	[2] 20,444,995	23,854,929	Petroleum, clays, uranium ore, vanadium, natural gas, stone, sand and gravel.
Fremont	[2] 57,497,802	58,001,824	Petroleum, uranium ore, iron ore, natural gas, sand and gravel, natural gasoline, LP gases, gem stones, beryllium concentrate.
Goshen	225,570	174,610	Lime, petroleum, sand and gravel, stone.
Hot Springs	[2] 52,501,145	55,714,039	Petroleum, natural gas, coal, natural gasoline, sand and gravel.
Johnson	[2] 18,893,700	18,329,662	Petroleum, natural gas, sand and gravel, natural gasoline, LP gases, uranium ore, gem stones.
Laramie	1,514,811	1,830,996	Petroleum, stone, sand and gravel, natural gas.
Lincoln	[2] 4,273,194	3,943,892	LP gases, coal, phosphate rock, sand and gravel, stone, gem stones.
Natrona	[2] 36,174,603	38,713,631	Petroleum, natural gasoline, natural gas, uranium ore, sand and gravel, LP gases, clays, sodium sulfate, gem stones, stone.
Niobrara	[2] 3,179,560	3,178,010	Petroleum, LP gases, natural gas, gem stones.
Park	[2] 88,328,249	96,027,908	Petroleum, natural gas, natural gasoline, LP gases, gypsum, sand and gravel, gem stones.
Platte	3,938,004	3,002,106	Iron ore, stone, sand and gravel, gem stones.
Sheridan	3,388,672	3,211,808	Petroleum, coal, sand and gravel, pumice.
Sublette	[2] 16,190,000	16,485,375	Natural gas, petroleum, sand and gravel, gem stones.
Sweetwater	[2] 45,652,038	47,870,532	Petroleum, sodium carbonate, natural gas, coal, LP gases, stone, sand and gravel, natural gasoline, gem stones.
Teton	10,910	94,220	Sand and gravel, stone, gem stones.
Uinta	[2] 1,820,800	1,647,233	Natural gas, petroleum, clays, sand and gravel, natural gasoline.
Washakie	[2] 10,042,608	9,220,120	Petroleum, natural gas, LP gases, lime, sand and gravel.
Weston	[2] 16,744,045	11,930,106	Petroleum, clays, LP gases, natural gas, sand and gravel.
Yellowstone National Park	109,240	21,400	Sand and gravel.
Undistributed [3]	[2] 3,618,892	7,863,361	
Total	[2] 466,247,000	485,777,000	

[1] Petroleum value is preliminary.
[2] Revised figure.
[3] Includes some sand and gravel, stone, and gem stones that cannot be assigned to specific counties.

Union Pacific Railroad Co. continued to investigate methods to process titaniferous iron economically from reserves north of Laramie.[13]

Big Horn.—Petroleum output for the county was approximately the same as in 1961. Of 17 active oilfields, Garland was the most productive with an annual output of 5.2 million barrels of crude oil from 135 wells, followed by Byron with 2.7 million barrels from 77 wells, and Bonanza with 1.1 million barrels from 51 wells. The county was ranked fifth in the State in oil production. Gas Processors, Inc., processed natural gas from the Garland field in two plants, one plant recovering natural gasoline and one plant recovering elemental sulfur.

Two companies, Magnet Cove Barium Corp. and Wyo-Ben Products Co., produced bentonite near Greybull. Lovell Clay Products Co. manufactured building brick, heavy clay pipe, tile products, and fire brick in a plant at Lovell. Holly Sugar Corp. processed limestone into quicklime in the beet-sugar refining plant at Worland.

Campbell.—In value of output, petroleum was the highest ranking mineral commodity produced in the county; the output was up 16 percent from that of 1961. Principal production from among 17 fields came from Raven Creek with an annual output of 2.2 million barrels, Rozet with 1.6 million barrels, and Dead Horse Creek with 0.5 million barrels. Wildcat drilling resulted in discovery of 10 oilfields. At Rozet field, N.C. Ginther operated a portable natural gas processing plant producing propane and natural gasoline.

Wyodak Resources Development Corp., a subsidiary of Black Hills Power and Light Co., produced subbituminous coal from a strip mine 6 miles east of Gillette for electric-power generation. Since 1921 the company had mined about 8 million tons from one of the World's thickest coal seams, which ranged from 40 to 102 feet. Uranium production was greatly below that of 1961.

Carbon.—Petroleum provided 52 percent of the value of mineral production, uranium ore 38 percent, and coal 7 percent. Petroleum production, 2 percent less than in 1961, came from 14 fields. Wertz field had the largest production with an annual output of 2.1 million barrels of crude oil; Rock River field had 686,000 barrels. Sinclair Refining Co., with the greatest annual throughput of the refineries in the State, processed 9.5 million barrels of crude oil. Marathon Oil Co., formerly Ohio Oil Co., operated the McFadden natural gas processing plant near Rock River, producing propane, butane, and natural gasoline.

Uranium ore was mined in the Shirley basin and west of Baggs Petrotomics Co. began operating its 500-ton-per-day mill in April and produced ore from an open pit near the mill. Utah Mining Corp., a subsidiary of Utah Construction & Mining Co., continued to operate its underground mine in the Shirley basin and to experiment with solution-mining techniques. Ore from the Utah Mining Corp. mine was processed at the Lucky Mc mill in the Gas Hills. Basin Engineering Co.; Sigma Mining Co.; and Trace Elements Corp., a unit of Union Carbide Nuclear Co. Division, Union Carbide Corp., mined

[13] Udy, Murray C. Smelting of Titaniferous Iron Ores of Wyoming. Min. Cong. J., v. 48, No. 10, October 1962, pp. 39–44.

and shipped uranium ore from the Poison basin west of Baggs to the Maybell mill in Colorado.

Coal production for the county increased 22 percent. Rosebud Coal Sales Co. and Hanna Basin Coal Co. increased output from their strip mines. Monolith Portland Midwest Co. operated a strip mine near Hanna. Mike & Harry Thomas produced a small tonnage from an underground mine near Savery.

Converse.—Petroleum accounted for 68 percent of the value of mineral production in the county, coal for 21 percent, natural gasoline and LP gases for 7 percent, and uranium for 2 percent. Crude oil production, decreasing 6.3 percent, came from nine fields. Oilfields were Big Muddy with 1.7 million barrels and Glenrock South with 1.6 million barrels. Discoveries during the year included one oil and three natural gas fields. Tower Mesa Verde Oil & Gas Co. operated a natural gas liquids processing plant in the Flat Top field at Shawnee and produced propane, butane, and natural gasoline.

Coal production decreased 7.3 percent. The largest production came from the Dave Johnston strip mine of Pacific Power & Light Co. Best Coal Co. operated a small strip mine near Verse in the northern part of the county. American Humates, Inc., began mining leonardite deposits near the Dave Johnston mine and processing the coal-like mineral into fertilizer products high in humic acid.

Uranium production decreased in tonnage and value. Western Nuclear, Inc., began strip mining from the Spook property in the Dry Fork area and in April started upgrading the ore in a preconcentrating mill. Vernon A. Mrak and B. & H. Mines, Inc., also operated open-pit uranium mines in the Dry Fork area. Most of the ore, except that from the Spook property, was processed in the uranium mill of Mines Development, Inc., at Edgemont, S. Dak. Vanadium was recovered as a byproduct of the uranium-ore processing at the Edgmont mill.

Crook.—Petroleum accounted for 66 percent of the value of mineral production in the county, followed by bentonite with 24 percent and uranium ore with 7 percent. Output of petroleum, increasing 24 percent above that of 1961, came from 21 fields. The fields leading in production were Coyote Creek with 2.2 million barrels, Donkey Creek with 996,000 barrels, and Miller Creek with 619,500 barrels. Six oilfields were discovered.

Bentonite (clay) output increased from 502,800 tons in 1961 to 536,000 tons in 1962. Producers were American Colloid Co., Baroid Division of National Lead Co., International Minerals & Chemical Corp., Black Hills Bentonite Co., and Archer-Daniels-Midland Co. Baroid Division and Archer-Daniels operated mills at Colony. Much of the bentonite mined in the county was prepared in plants in Weston County, Wyo., and in South Dakota.

Uranium ore was mined at five underground operations by three operators, and the value was 16 percent greater than in 1961. Homestake Mining Co., operating the Hauber mine near Hulett, had the largest production. This company entered into a new development phase in 1962, extending mining as far as 1 mile from the main shaft. Other producers were Balboa Mining & Development Co. and Geo. Resources Exploration, Inc. Ore was processed at Edgemont, S. Dak.

Sand for building and paving and crushed stone for road construction also were produced in the county.

Fremont.—Fremont continued to have the second highest value of mineral production among the counties. Petroleum supplied 59 percent of the output value and uranium ore 29 percent. Crude oil output for the year, about the same as for 1961, came from 28 fields. The fields with the largest annual production were Beaver Creek with 3 million barrels, Steamboat Butte with 2.9 million, Winkleman Dome with 2.4 million, and Big Sand Draw with 1.4 million. Wildcat and development drilling, considerably greater than in 1961, resulted in discovery of one oil and four natural gas fields. In 1962, Pan American Petroleum Corp. increased average daily throughput of natural gas at its Beaver Creek processing plant from 29 to 32 million cubic feet. The daily average output of the plant for the year was 10,000 gallons of propane, 11,100 gallons of butane, and 10,100 gallons of natural gasoline.

TABLE 12.—Uranium mines in Fremont County in 1962

Mine	Operator	Locality	Type of mine
Andria Nos. 1, 2, 5	F A B Metals Mining, Inc.	Gas Hills	Open pit.
Arrowhead Nos. 1, 2	Susquehanna-Western, Inc.	Copper Mountain	Underground.
Bart Nos. 1, 2, 3	Utah Mining Co. (Utah Construction & Mining Co.)	Gas Hills	Open pit.
Bullrush	Western Nuclear, Inc.	do.	Do.
Cal Nos. 14, 15	Federal-Gas Hills Partners	do.	Do.
Clyde Nos. 1–4	do.	do.	Do.
Copper Mountain	H. H. Bowen	Copper Mountain	Underground.
Day Berger Lease	Malcolm J. Reeves	do.	Open pit.
Dee Nos. 1, 2	Globe Mining Co.	Gas Hills	Do.
Dick Nos. 9, 11, 15	do.	do.	Do.
Frazier Lamac	Western Nuclear, Inc.	do.	Do.
Jay No. 2	Vitro Minerals Corp.	do.	Do.
John No. 2	do.	do.	Do.
Loco Nos. 16, 21, 27, 29	Federal-Gas Hills Partners	do.	Do.
Loma	Western Nuclear, Inc.	do.	Do.
Nels No. 2	Globe Mining Co.	do.	Do.
Pay No. 5	do.	do.	Do.
Paydirt	Western Nuclear, Inc.	Crooks Gap	Do.
Rim No. 55	Western Uranium Corp.	Gas Hills	Do.
Sagebrush No. 4	Federal-Gas Hills Partners	do.	Do.
School Section 16	Dale B. Levi	do.	Do.
Sections 16, 28, 29	Green Mountain Uranium Corp.	Crooks Gap	Underground.
Seismic-Reserve	Continental Uranium Company of Wyoming.	do.	Do.
Sunset No. 7	Atlas Minerals	Gas Hills	Open pit.
Thunderbird No. 9	P. C. Mining Corp.	do.	Do.
Windy	Continental Uranium Company of Wyoming.	Crooks Gap	Underground.

Source: U.S. Atomic Energy Commission.

The county had the largest uranium-ore output in the State. The Gas Hills supplied 83 percent of the county production, the Crooks Gap area 15 percent, and the Copper Mountain area 2 percent. All of the Gas Hills output came from open pits, although some underground operations penetrated the walls of the pits to reach small pods of ore extending beyond the open-cut excavations. The Lisbon mine was being developed for underground operation. The Paydirt mine in the Crooks Gap area and the Reeves pit in the Copper Mountain area were open pit; all other mines in these areas were underground.[14]

[14] Roscoe, John G. Automated Hoisting Pays Off at Two Small Wyoming Mines. Min. Eng., v. 14, No. 7, July 1962, pp. 46–48.

Four of the six uranium mills in Wyoming were in Fremont County; the four mills were operated by Utah Construction & Mining Co. and Federal-Gas Hills Partners in the Gas Hills; Western Nuclear, Inc., at Jeffrey City; and Susquehanna-Western, Inc., at Riverton. Western Nuclear, Inc., included heap leaching as part of its operation. This company completed a sulfuric acid plant at its Split Rock mill site and began producing acid for uranium-ore processing. Susquehanna-Western, Inc., also produced sulfuric acid at its uranium-ore mill at Riverton. A report on mining practices in the Gas Hills [15] was published. The Atlantic City iron ore project of Columbia-Geneva Steel Division of United States Steel Corp. was completed, and in August the first iron agglomerates were shipped by rail to company furnaces at the Geneva Works near Provo, Utah.[16] Regular operation at the project required the services of approximately 450 people.

The county was second in value of sand and gravel output. Commercial operations supplied sand and gravel valued at $488,800; noncommercial, $46,300. According to value, 51 percent of the gem stones collected in the State came from Fremont County. Much of the green and black jade (nephrite), for which the State is noted, came from the area near Jeffrey City. Hand-cobbed beryl was recovered from two pegmatite deposits in the Copper Mountain area north of Shoshoni.

Goshen.—The value of the mineral production decreased from $225,570 in 1961 to $174,610 in 1962. Crude oil production, down 56 percent, came from the Torrington field. Holly Sugar Corp. produced 7,400 tons of lime from limestone for use in the beet-sugar refining plant at Torrington.

Hot Springs.—The county retained its rank of second in the State in petroleum production. Output increased 6 percent and came from 15 fields. Fields with more than 1 million barrels annual production were Hamilton Dome, 9.0 million barrels; Grass Creek, 5.1; Murphy Dome, 2.2; and Little Buffalo, 2.0. The Empire State Oil Co. refinery had a throughput of 3 million barrels, about the same as in 1961. Gas Processors, Inc., processed natural gas from the Grass Creek field for an average daily throughput of 1.6 million cubic feet and an average daily output of 2,000 gallons of natural gas for the year. Coal output, 11,400 tons, came from three underground mines. Dusky Diamond Coal Co. operated the Grass Creek mine, Roncco Coal Co., Inc., the Roncco mine, and T–K Coal Co., the Coleman mine. One sand and gravel company reported production.

Johnson.—Petroleum, natural gas, natural gas liquids, and sand and gravel accounted for most of the mineral production in the county. Nine fields yielded crude oil, the largest being Sussex with an annual output of 2.6 million barrels, followed by North Fork with 1.1 million and Meadow Creek with 880,900. One oilfield was discovered. The natural gas processing plant at Linch, operated by Continental Oil Co., had an annual average daily throughput of 15.8 million cubic feet of gas that yielded an average daily output of 13,900 gallons of

[15] Everett, F. D. Mining Practices at Four Uranium Properties in the Gas Hills, Wyoming. BuMines Inf. Circ. 8151, 1963, 83 pp.
[16] Mining World. Atlantic City: West's First Taconite Operation Ships on Schedule. V. 24, No. 11, October 1962, pp. 16–18.

propane, 10,800 gallons of butane, and 7,400 gallons of natural gasoline. Four commercial sand and gravel producers reported an output of 85,400 tons valued at $139,800; two noncommercial producers reported 163,900 tons and $204,400.

Laramie.—Crushed stone output (limestone and granite) had the greatest value of the minerals produced, followed by petroleum and sand and gravel. The Great Western Sugar Co. mined and crushed limestone from the Horse Creek mine north of Cheyenne for use in beet-sugar refining and as railroad ballast and road-construction aggregate. Union Pacific Railroad Co. contracted with Morrison-Knudsen Co., Inc., to mine, crush, and screen granite at the Granite Mountain quarry; the sized rock was used for railroad ballast and riprap. Granite for road aggregate was produced by a contractor for the Federal Forest Service. Crude oil production, up 27 percent for 1962, came from five fields; the largest field was Horse Creek with 220,000 barrels output. One oilfield was discovered. At Cheyenne, Frontier Refining Co. operated an oil refinery with an annual throughput of 6.4 million barrels, 2.4 percent greater than for 1961.

Lincoln.—Coal was the second major mineral commodity in value of production; the output increased from 282,200 tons in 1961 to 333,500 tons in 1962. The Kemmerer Coal Co. operated the Brilliant No. 8 underground mine at Frontier and contracted the strip mining at the Elkol mine to Morrison-Knudsen Co., Inc. A new strip-mine area near the Elkol mine was allocated to the future needs of the Utah Power & Light Co. coal-based powerplant; this area, known as the Sorensen mine, was under development in 1962. The first-stage unit of the powerplant was scheduled for completion in June 1963.[17] The pilot plant jointly operated by FMC Corp. and United States Steel Corp. produced several thousand tons of coke briquettes from subbituminous coal mined near Kemmerer. Reportedly, tests using the coke were successful; investigations of the process to make coke briquettes were to continue.

Phosphate-rock production by San Francisco Chemical Co. increased 21 percent above that of 1961. The company operated a concentrating plant at Sage, where ores from Utah and Wyoming were processed. Most of the concentrates were shipped to out-of-State purchasers to be used in manufacturing fertilizer. One commercial sand and gravel operation was reported.

El Paso Natural Gas Co. processed natural gas in a plant at Opal; for the year the average daily throughput of natural gas was 229.4 million cubic feet; the average daily output was 74,000 gallons of propane, 27,500 gallons of butane, and 67,000 gallons combined LP products and natural gasoline.

Natrona.—Eighty-seven percent of the mineral production value of the county came from crude oil. Output for the year came from 26 fields, the largest being Salt Creek with 7.2 million barrels and Grieve Unit with 2.5 million barrels. One oilfield was discovered. Refineries were operated by Texaco Inc. with an annual throughput of 9.0 million barrels, American Oil Co. with 8.6 million, and Socony-Mobil Oil Co., Inc., with 3.8 million. Natural gas was processed by Pan

[17] Fagnant, John A. Wyoming Company Preparing to Send Coal by Wire to Utah Power & Light. Min. Eng., v. 14, No. 8, August 1962, pp. 37–40.

American Petroleum Corp. at the Salt Creek field plant; for the year the daily average throughput was 27 million cubic feet, and a daily average output was 27,000 gallons of propane, 35,000 gallons of butane, and 45,000 gallons of natural gasoline.

Globe Mining Co. Division, Union Carbide Corp., mined uranium ore from five operations and processed the ore in its mill in the eastern Gas Hills area. The uranium ore output from the county was 37 percent above that of 1961.

Benton Clay Co. mined bentonite from deposits near Midwest and Natrona and processed it in a plant at Casper. W. E. Pratt continued to harvest sodium sulfate from a saline lake deposit near Natrona. The county had the largest value in sand and gravel produced in the State. Several individuals reported collecting jade (nephrite).

Niobrara.—Petroleum and natural gas output comprised most of the total value of mineral production for the county. Crude oil output, about the same as for 1961, came from nine fields, the largest being Lance Creek with an annual production of 745,500 barrels. One oilfield discovery was reported. Marathon Oil Co. processed natural gas at a plant in the Lance Creek field. For the year this plant had a daily average throughput of 2.1 million cubic feet and a daily average output of 3,525 gallons of propane, 3,180 gallons of butane, and 4,110 gallons of combined gasoline and LP gases.

Park.—Mineral production for Park County was up 9 percent, with increased output reported for petroleum, natural gas, natural gas liquids, and gypsum. The county was ranked first in petroleum production, which came from 24 fields; the principal fields were Elk Basin, the largest producing field in the State, with an annual output of 20.3 million barrels; Oregon Basin with 6.4 million; Fourbear with 2.7 million; and Frannie with 2.1 million. Husky Oil Co. refined 3 million barrels of oil, an increase of 4.4 percent above that of 1961. One oil and one natural gas field discovery was reported. Pan American Petroleum Corp. processed natural gas in a plant at the Elk Basin field. This plant had a daily average throughput for the year of 15.5 million cubic feet and a daily average output of 19,500 gallons of propane, 30,000 gallons of butane, and 45,000 gallons of natural gasoline. Gas Processors, Inc., operated a natural gas plant at the South Elk Basin field. This plant had a daily average throughput for the year of 7.0 million cubic feet and a daily average output of 1,900 gallons of natural gasoline. Pan American Petroleum Corp. and Texaco Inc. produced elemental sulfur from sour natural gas in the Elk Basin field.

Big Horn Gypsum Co., in its second year of operation, manufactured plasterboard from gypsum mined near Cody; gypsum requirements were almost double those of 1961. Multi Mineral Production Corp. shipped crushed gypsum from a stockpile mined in 1955 to consumers for agricultural use. Three commercial and two Government-and-contractor sand and gravel operations were reported.

Platte.—Iron ore accounted for most of the value of mineral production. Activity at the CF&I Sunrise mine was reportedly less than in 1961. The company continued development work on the seventh level of the mine.

Guernsey Stone Co. quarried dolomite, which was used as railroad ballast, riprap, and road-construction aggregate. Gem-stone collectors found agate and onyx valued at $2,450. One commercial sand and gravel operation was reported.

Sheridan.—The value of mineral output decreased 5 percent. Although petroleum supplied 58 percent of the total mineral value, output was 76,000 barrels less than in 1961. Two fields accounted for the production—Ash Creek-S with 434,000 barrels and Ash Creek with 266,000 barrels.

Big Horn Coal Co. and Welch Coal Co. together increased production from their strip mines by 8,000 tons over that of 1961.

Tongue River Stone Co. increased its scoria output by 21,700 tons. The crushed and sized products were used for railroad ballast. Three commercial and two Government-and-contractor sand and gravel operations were reported.

Sublette.—The total value of natural gas, petroleum, and sand and gravel was 2 percent greater. California Oil Co., Western Division, began construction of two natural gas processing plants at the Birch field; tentative plans called for a 16 million cubic feet daily throughput adsorption unit to recover 2,400 gallons per day of liquids, and a 3 million cubic feet daily throughput refrigeration unit to recover 15,000 gallons per day. The plants were scheduled for completion late in 1963. Petroleum output, greater by 600,000 barrels, came from 14 fields, the largest being Big Piney Shallow with 800,000 barrels, followed by the Tip Top Shallow with 377,000, Birch Creek with 336,000, and La Barge with 335,000. Two new fields were reported, one oil and one natural gas. Increased road construction caused an advance in sand and gravel output.

Sweetwater.—The value of mineral production in the county increased 5 percent although decreases were reported for petroleum and coal. Petroleum was the principal commodity, supplying 54 percent of the mineral value for the county. Crude oil output came from 18 fields; Patrick Draw was the largest producer with 3.4 million barrels, followed by Lost Soldier with 3.1 million, and Arch Unit with 2.9 million. Two oilfields and seven gasfields were discovered. Three natural gas processing plants were operated—the Sinclair Oil & Gas Co. Baroil plant with an annual daily average throughput of 4 million cubic feet and a daily average output of 4,500 gallons of combined gasoline and LP gases; the Union Pacific Railroad Co. Bitter Creek plant with a daily average throughput of 24.8 million cubic feet and a daily average output of 20,200 gallons of propane, 16,355 gallons of butane, and 14,220 gallons of combined gasoline and LP gases; and the Gas Processors, Inc., Patrick Draw field plant with a daily average throughput of 3.4 million cubic feet and a daily average output of 2,700 gallons of propane, 1,900 gallons of butane, and 2,000 gallons of natural gasoline.

The closure of the Superior D. O. Clark mine on March 30 and the Rock Springs No. 8 mine on August 20 by the Union Pacific Coal Co. caused a decline in coal production. Gunn-Quealy Coal Co. and Edwin L. Swanson Brothers' remained as the only coal producers in the county. Gunn-Quealy Coal Co., with the same management as

The Kemmerer Coal Co., announced plans for coal research at a plant to be constructed near Rock Springs.

Increased soda ash production from trona by FMC Corp., Inorganic Division, and Stauffer Chemical Co. of Wyoming accounted for most of the advance in value in mineral output for the county. FMC Corp. completed a plant expansion providing for a new production capacity of 700,000 tons of soda ash. Stauffer Chemical completed the development of its mine and its processing plant and began operating in June.[18] After operating for several months, Stauffer Chemical announced plans for expansion to increase annual plant capacity from 200,000 to 400,000 tons of soda ash. This expansion, mainly of the plant, was to begin in June 1963. The Diamond Alkali Co. and Olin Mathieson Chemical Co. donated 20,278 feet of drill cores to the Geological Survey of Wyoming. The cores, from holes drilled for trona in the Green River basin, were to be stored at Laramie in the Survey core repository for future reference.

Sand and gravel output, all by two commercial and one Government-and-contractor producers, was greater because of more road construction.

Gem stones valued at $7,400 were collected; agatized wood, opal, obsidian, agate, and fossils were the principal stones.

Teton.—Sand and gravel output, reported by one commercial operator and two Government-and-contractor operators, had the highest value of the mineral commodities produced in the county. Utah-Idaho Sugar Co. mined limestone in Fox Creek Canyon east of Victor, Idaho. The limestone was crushed and shipped to beet-sugar refineries in Idaho. Gem stones collected were valued at $300.

Uinta.—Natural gas and petroleum output together accounted for the principal portion of the value of mineral production. Natural gas production increased 68 percent. Mountain Fuel Supply Co. operated the Church Butte field natural gas processing plant with an annual daily average throughput of 55 million cubic feet and a daily average output of 1,000 gallons of natural gasoline. Petroleum production, all from two fields, declined 71 percent.

About 18 miles north of Evanston, Interstate Brick Co. of Salt Lake City, Utah, mined miscellaneous clay, and International Pipe & Ceramics Corp., formerly Gladding, McBean & Co., mined fire clay. The miscellaneous clay was used to make white building brick. One commercial sand and gravel operation was reported.

Washakie.—Petroleum and natural gas output accounted for most of the value of mineral production. Petroleum output was down 479,000 barrels and natural gas output declined 1.2 billion cubic feet. Crude oil production came from 11 fields; Cottonwood Creek, with 1.5 million barrels output, was the largest producer. One new oil field was reported. Three companies processed natural gas: The Pan American Petroleum Corp. Cottonwood Creek plant had an annual daily average throughput of 12 million cubic feet and a daily average output of 6,000 gallons of combined gasoline and LP gases and elemental sulfur; the Pure Oil Co. Worland field plant had an annual daily average throughput of 50 million cubic feet and a daily average output of

[18] Mining Engineering. Stauffer Reaches Wyoming Trona. V. 14, No. 1, January 1962, p. 22.

36,000 gallons of propane, 6,500 gallons of butane, and 31,500 gallons of combined gasoline and LP gases; and Texas Gulf Sulphur Co. processed 20 million cubic feet of natural gas from the Pure Oil Co. and produced byproduct elemental sulfur at a plant 9 miles north of Worland.

Holly Sugar Corp. produced lime from limestone for beet-sugar refining at Worland.

Weston.—Petroleum production, 36 percent less than in 1961, came from 21 fields; Fiddler Creek with an annual output of 1.4 million barrels was the largest producer. One oilfield was discovered. Sioux Oil Co. operated its Newcastle oil refinery with a throughput of 7.9 percent more than in 1961. Natural gas was processed by two companies: N. C. Ginther operated the Lonetree field plant with an annual daily average throughput of 4 million cubic feet and a daily average output of 7,000 gallons of propane and 8,000 gallons of combined gasoline and LP gases, and Hy-Gas Products Co. operated the Clareton field plant with an annual daily average throughput of 2.3 million cubic feet and a daily average output of 2,000 gallons of propane and 4,000 gallons of combined gasoline and LP gases.

Bentonite output was increased 31 percent. American Colloid Co., Archer-Daniels-Midland Co., and Baroid Division of National Lead Co. operated bentonite preparation plants in the county. One commercial and one Government-and-contractor sand and gravel operation was reported.

Yellowstone Park.—One Government-and-contractor sand and gravel operation reported production, mostly used for road construction.

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